Concrete

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Construction Methods *and* Form Details

on New Sewer and Treatment Plant at Springfield, Ill.

Project Embraces 22,000 Ft. of Monolithic Sewer, 21,000 Ft. of Precast Concrete Pipe, Concrete Trestles and Treatment Plant—All Concrete Placed Under Quality Control Methods—Job Layout—Mixing and Placing Details—Construction Difficulties—Form Details

IN Springfield, Illinois, there has recently been completed a new sewer system and sewage treatment plant incorporating some unusual design and construction features. The project as outlined included three major improvements.

First, the construction of a system of intercepting sewers around the margin of the city, designed to collect sewage from eleven main sewer outlets.

Second, the transportation of this collected sewage to a sewage treatment plant located remotely from the city where the sewage could be treated in a modern manner and rendered harmless.

Third, the design and construction of lateral, sanitary sewers in areas outside the city limits and in territory not then served by the existing sewer system.

The estimated cost of the project was placed at $2,300,-

The construction plant of the Lock Joint Concrete Pipe Company, where units used in the Springfield sewer system were produced

000. To finance the program the voters approved a bond issue of $1,500,000 and an increase in the tax levy of one third of one per cent.

The Sewer System

The sewer system is composed of two divisions—an east side interceptor and a west side interceptor. The east side interceptor is 39,000 ft. long and runs from a point south of the city around the east city limits to the sewage treatment plant at the north. This sewer ranges in size from 36 in. to 66 in. and is designed for a capacity 25 times normal dry weather flow. At a point east of the city a pumping station with four pumps is cut into the line. A storm water treatment plant is proposed here for later construction.

The west side interceptor begins south of the city, turns north along the west city line, takes a sharp swing out to the line of the Sangamon River and follows the low land northward to the treatment plant. This line is 51,000 ft. long with pipe ranging from 15 to 69 in. This line has an ultimate capacity of 425 g.p.d. per capita.

There is more than 22,000 ft. of 66-in. to 69-in. monolithic concrete sewer and about 21,000 ft. of 27-in to 36-in. precast concrete pipe in the project. Large quantities of concrete were used behind the segmental block of the tunnels, in a 650-ft. monolithic concrete-lined tunnel and as bedding for the pipe.

The laying of these two interceptor lines entailed some unusually difficult cuts and tunneling operations. On the lower end of the east side line the cut ranged from 6 to 20 ft. deep. Here the contractor used a dragline machine and also a trenching machine which worked in conjunction with a special backfiller. This backfiller was about 100 ft. long and consisted of a belt operating on a steel frame hung between the legs and an "A" frame. The belt received dirt from the trencher and carried it 100 ft. down the trench where it dumped it into the ditch. Under favorable conditions as much as 300 ft. of 5- by 16-ft. ditch could be cut, piped and backfilled in one 10-hour working day, while the average over a long period was 80 ft. of 36-in. pipe laid on a 4-in. bed of concrete.

Pipe Laying Methods

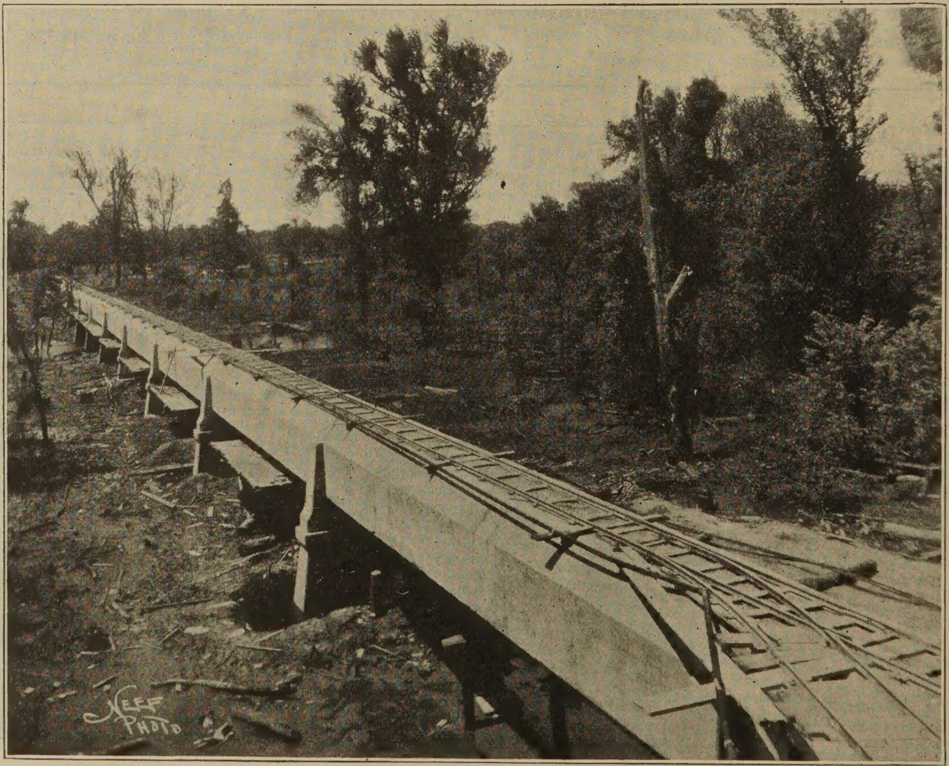
Laying pipe under conditions entailed by poor soil conditions and much ground water was not the easiest job for the contractor. The best practice was found to keep the pipe operations as close behind the trenching machine as possible. A crawler crane placed the pipe in position directly on the ground if the trench was dry and soil firm or on a bed of concrete where conditions were adverse. This concrete mat of course did not have time to set. The concrete was mixed in a small portable mixer which moved along the side of the trench. From the mixer the concrete was chuted into position in the trench. The mix for this cradle was 1:3:6 using coarse gravel. The concrete was not designed under a strict water-cement specification, but 6½ gallons of water was the maximum allowed.

In those sections of the trench where soil and water conditions were very bad a 4-in. tile drain was laid under the pipe. The trench was excavated by the trencher to a depth about 2 in. below the bottom of the pipe barrel. Then a 12-in. by 12-in. trench was dug by hand and the 4-in. pipe laid in and surrounded with gravel. In some places the soil of the trench was so soft that a man walking into the trench alongside the small ditch caused the soil to slide into the bottom. After the drain tile was laid, stepping on the tile caused it to sink entirely below grade. The contractor overcame this by laying the tile units in a wooden trough or by laying a cover of 1-in. planks nailed together over the drain line in addition to the trough.

One unit of the west side interceptor branched off the main line and ran into the city. In this section of the job

(Continued on page 53)

One section of the 2100 *ft. trestle, having an inside diameter of* 66 *inches*



Building a Concrete Pavement

10,000 Feet Above Sea Level

High Elevation Introduces Unusual Construction Difficulties—Great Temperature Changes—Rocky Soil Makes Dirt Curing Impossible—Slag Aggregate Used

TEN thousand feet above sea level lies Leadville, Colorado. This fact may not, in itself, be remarkable, but the fact that in this town a concrete pavement, the highest known in the world, has just been built successfully, surely is. Added to the high altitude are other, and even more interesting features, for the concretor's reading. But the story cannot really be told without first giving some of the history of this famous old mining town.

A Colorful History

In the year 1860 two bands of hardy prospectors crossed Great South Park in Colorado and found themselves at the headwaters of the Arkansas River. To the west of the spot where the prospectors camped stretched a wild and wooded valley with rising foothills and the glistening peaks of the Saguache range blotting out the sun. Hundreds of miles of wilderness and hostile territory lay between these men and the civilization of the Middle West. Before them lay more unknown hundreds of miles and within the range of their eyes stretched a vast territory—theirs for the taking.

Of course you've read of the wicked ways
Of Leadville town in the early days,
Of the "killers" and "grafters" who lived there when
The place was peopled by gambling men,
When it cost a fortune to eat and sleep,
When life and morals both were cheap,
And one owned all one could get—and keep.

This was 'way back in seventy-nine,
When every claim was a paying mine,
When money and suckers both were thick
And prospectors sold without stroke of pick,
Then the boys and the camp were thoroughbred,
One got drunk and painted the other red,
And maybe wound up half filled with lead.

—F. E. VAUGHN,
The Ballad of Chicken Bill.

The little band began prospecting in two valleys of the Mosquito range on which they stood. Almost the first pan of dirt washed showed such traces of the yellow metal that the men named the valley California Gulch. And it indeed proved to be another California since for more than twenty years scores of men carried back abundant fortunes. More than $20,000,000 of new wealth left the gulch before a single lode claim was sunk.

Yet in spite of these rich deposits, the real wealth of the region had not then been tapped. It was not until 1879 that the black sand which clogged the sluice boxes was ascertained to be lead carbonate, heavy with silver. Then the real boom began and men from all corners of the world came to the Leadville district to find fortune.

From a few straggling miners' cabins scattered over the hills and through the valleys, a new city began to take form. Streets were laid out, business came on the heels of the miners, machinery and equipment replaced the crude sluice boxes and shovels of the early miners, scrub covered land became streets and Leadville began its march to world renown.

Easy Come, Easy Go

To the young Leadville flocked the gamblers, the card sharps, the traders, the gun men—all those who lived by quickness of eye or hand. Millionaires flowered overnight. Over the mountain passes the newly rich brought bricks and lumber and cement and along the streets built great commercial houses and residences. Fortunes in fittings and furnishings were spent on the interiors of these places. Millionaires lavished their new wealth on hotels, opera houses, saloons and gambling houses. To the theaters came the best talent of the time, for Leadville knew no bounds in cost and paid the highest salaries in the country. The hotels became world famous for the wealth of their furnishings, the lavishness of their cuisines, the variety of their bars. Indeed, one hotel placed a piano in every room and on opening night served a banquet to a selected guest list which when assembled represented capital of $80,000,000.

But this great prosperity could not last. Shafts began to encounter heavy ground water and shallow holes did not all turn out to be bonanzas. The gambling population began to drift to other camps; miners heeded the call of the itching foot, and the population dwindled rapidly.

But nature had yet other—and greater—riches waiting to be opened up. Engineers sank their shafts below the water belt and new lodes were opened. In startling succession gold, silver, copper, lead, iron, zinc, manganese, bismuth and now molybdenum were brought to light. Renewed prosperity began. But these mines required greater capital, expensive machinery, experienced men and the little miner with his hand tools had to go. The city decreased in population, but gained a stable production which has since held.

Through the years of fortune and famine, the stable population maintained its belief in the city and its future and could not be shaken even by the fall in the price of silver, the petering out of rich veins, or a dwindling population. This faith in the future of the city is exemplified in the paving program begun last year.

The principal street is Harrison Avenue. It was on this street that the hotels, the saloons, the gambling houses, stood. In the boom days the street was filled from building to building with milling herds of men. Gamblers rubbed shoulders with ministers, miners jostled millionaires, drunkards walked with dudes.

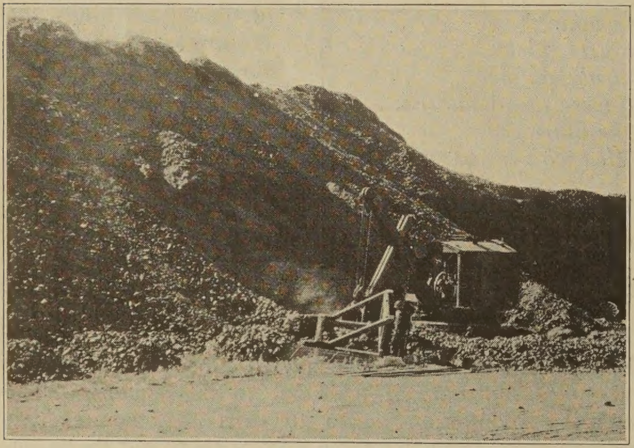
Some of the Construction Difficulties

During the years the old street had been serving traffic, it had been surfaced many times. Layer was piled on layer to replace material lost to wind, water and the elements. It is said in Leadville that if the material of the old street were run through a smelter it would assay a goodly number of dollars per ton. The finer materials were carried away year by year leaving only the boulders and heavy materials. Such a surface made subgrading difficult and also brought out the problem as to what kind of curing could be used without expensive hauling in of dirt or sand.

Other problems make this paving job especially interesting. Leadville, first of all, is 10,000 ft. above sea level. Its winters are severe and long. Even when the lowlands are enjoying spring and fall weather, Leadville has cold nights when the temperature drops below freezing and is often accompanied by snow flurries and rapid changes of temperature. Any pavement which might be selected for Leadville would be sure to be given an extraordinarily severe test for strength, permanency, and ability to withstand exposure.

All present day materials were investigated, and after the conferences were over, concrete emerged as the material the engineers, city officials and citizens felt would best meet their needs. The modernization of Harrison Avenue had begun.

The first requisite for the concrete pavement was that it possess high strength. Without such strength, the pavement could not hope to withstand the rigors of Leadville's climate. The engineering firm of Watrous and Tipton of Alamosa, Colorado, were retained to design the mix and to supervise the work. The contract was let to the Driscoll Construction Company of Pueblo.

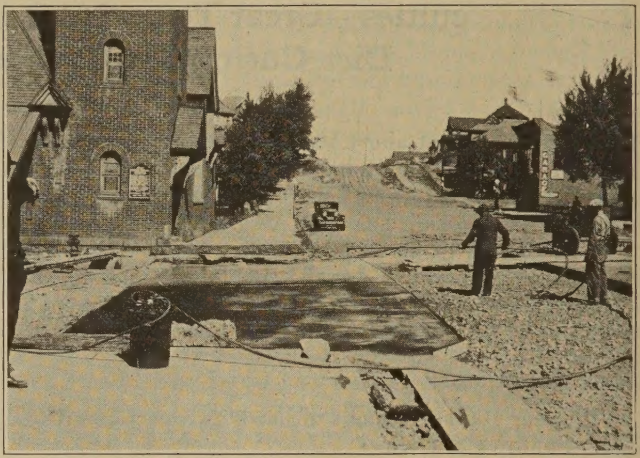


The slag pile for coarse aggregate. The steel grizzly and its frame are under the crane boom

Slag Aggregate Used

Selecting the aggregates for the mix proved quite an experiment. The local sand proved to be quite harsh, and coarse aggregate was limited to crushed rock or slag. The slag was selected, which together with the local sand, made a mix that proved too harsh for practical work. Outside sands were tried, with the final mix using a 50-50 per cent mixture of local sand and sand shipped in from Pueblo.

Local slag from one of Leadville's numerous dumps was used. The slag was heavy, had been air cooled, was in large pieces and had a very dark color. The slag was blasted and shoveled from the slag piles and broken up into usable pieces by dropping a heavy weight from a crane. After crushing, the slag was passed through a grizzly which held out all material over 3 in. in size. The slag was further crushed to give a variable grading and provide some smaller sizes.



Applying the Hunt curing process. The panel has just been poured. The tank in the foreground contains the emulsion, and the compressor may be seen in the background

The fall weather also brings to the mountains sudden rains which are heavy, though of short duration. Fresh concrete needs every protection to withstand such rains, so the contractor built wood frames covered over with tightly stretched canvas. These not only served to keep rain off the pavement, but also kept the noonday sun off the fresh concrete and in emergency could be laid at intersections to keep pedestrians off the concrete.

Curing Method

The Hunt process of curing was selected by the engineers because it offered several advantages which were likely to prove of value. In the first place the use of this method eliminated the necessity of water curing, which, either by ponding or wet earth, offered difficulties. Material for wet earth curing was not plentiful and would have to be hauled some distance. Ponding required earth or sand for dikes, also difficult. The subgrade was mostly rocks, not the best curing material by any means. By using the Hunt process this need for earth or sand was eliminated.

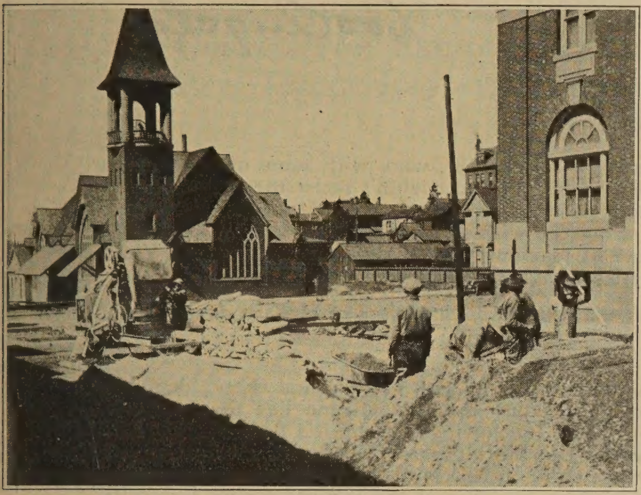
A second feature which appealed to the engineers and the contractor was the quickness with which the process could be applied. During the work the concrete was sprayed on right behind the mixer. In most instances the curing material was applied to the panel just behind the one the mixer was working in. This reduced the number of men required by the contractor and permitted curing to begin without loss of time.

This process of curing, the engineers found, provided a seal for the surface and a film of material which proved so strong that sudden rains did not penetrate to pit the surface of the concrete, providing the curing film had had a few hours to set.

During the laying of the concrete, several drops in temperature to below freezing occurred, yet cylinders broken consistently showed average strengths of 3000 pounds, the designed strength, with numerous cylinders exceeding this designed strength. This seemed to indicate that the process sealed the concrete against cold weather, loss of strength, and adequately held the mixing water within the slab.

Pavement Design

The slab is of thickened edge design with 9 in. edges, both center and outside edge, with a 6-in. center thickness. The thickened edge begins 2 ft. in from each edge. Transverse joints are spaced at 25-ft. intervals and are filled with a ½-in. premolded material. Both the joint and the filler extend clear through the slab and the contractor used great care to get these joints exactly perpendicular to the subgrade. No reinforcing was used in the slab.



Showing the mixer and the aggregate piles

The pavement was finished by hand, finishing operations consisting of one screeding following placement of concrete, then a floating with a longitudinal float and a final belting. The contractor used care in setting his side forms to see that the surface of the slab should be as smooth and even riding as possible. These side forms were left in place where gravel was put outside the pavement to prevent edge breaking.

Concrete was transported from the mixer to the subgrade in buggies. Finishing operations consisted of screeding, hand floating and belting

The contract for the job totaled about 10,000 sq. yds. The pavement is 30 ft. wide and was laid in two strips with a butt joint, but without joint filler or dowels. This width does not fill the street from curb to curb, but the city officials planned to fill in the remaining 13½ ft. between the slab and the curb with a rolled gravel surfacing. This gravel surfacing would not carry heavy traffic, but would serve for parking. But the business men along the street were so favorably impressed with the new pavement that they asked the contractor for prices to fill in the 13½ ft. with a 6-in. uniform slab. Before the main slab had all been laid more than one-half of the outside strips had been paved at the expense of the individual property owners.

All the concrete for the project was mixed in a small portable mixer which was moved along the subgrade ahead of the work. The mixer was loaded by barrow and concrete was buggied to position.

The cost of the new pavement was taken out of general city funds and no assessments were levied against property owners.

The contractor for the job was the Driscoll Construction Company of Pueblo, Colorado.

Building Officials' Conference Holds 15th Annual Meeting

The Building Officials' Conference of America held its fifteenth annual meeting in the William Penn Hotel in Pittsburgh from April 22nd to April 26th, inclusive.

The hotel sessions alternated with inspection trips to nearby industrial centers during three days of the convention period. In general this meeting emphasized the renewed interest in this organization, since for the first time in several years the secretary was able to report a substantial increase in membership. There was also an increase in the number of building inspection officials in attendance.

The program of papers and talks was somewhat overcrowded, as a result of which there was little opportunity for discussion. Papers of particular interest to the concrete industry included a report on "Masonry Wallette Tests," by John M. Bischoff, commissioner of buildings of Detroit, and a description illustrated with moving pictures of a 4-hour fire-and-water test of a floor panel of "aerocrete" construction at Columbia University, reported by Thomas Heatley, engineer for the bureau of buildings, Borough of the Bronx, New York City.

The most important series of the Detroit tests included eight piers of clay brick, three of concrete brick and three of sand-lime brick. These tests emphasized the same characteristic observed at similar tests conducted at the laboratories of Columbia University and the United States Bureau of Standards. That is, the "wall efficiency" of the concrete brick was considerably higher than that of the clay brick. This is simply another way of saying that the adhesion between the concrete brick and the mortar was considerably greater than between the clay brick and the mortar.

A preferential vote on the next convention city resulted in about an equal division between Indianapolis and Cleveland; but the final decision will, as usual, be made at a late date by the executive committee. Officers for the coming year include, for president, Robert Knight, Deputy Commissioner of Buildings, Chicago; for vice-president, Jay T. Williams, Chief Building Inspector, Denver; and for secretary, Col. John W. Oehmann, inspector of buildings, Washington, D. C.

P. G. RILEY
President

P. G. RILEY
GENERAL CONTRACTOR

~~701 Temple Street Bustown, N. Y.~~

T. G. McGOVERN
General Supt.

Los Angeles

Dear Mac:

The other evening while strolling around downtown waiting for mother, who, with some of her women friends was enjoying a show, I noticed a good sized construction job and couldn't resist the temptation to inspect it. I ran into John Livingston, a young, highly educated and sometimes cynical contractor whom I had argued with at the club several times as I naturally disagreed with some of his new-fangled ideas. He was standing and solemnly viewing a seemingly new piece of machinery as I came up and I said, "Well, John, why the sad and solemn look? Are theory and practice disagreeing again?"

"Yes, you would bring that up. Look over there. Isn't that a nice looking piece of modern equipment?"

"Yep," says I, "looks like a nice paint job. What's wrong with it?"

"Listen, Mr. Riley, that thing is a creature of low cunning dressed up with modern and showy doodads, but in the course of its vain and idiotic existence it has deliberately told ninety-nine lies to one truth. You'd naturally think that being just a piece of machinery and not having a brain, it'd be a straight forward and eminently honest machine. But not so, my friend. It's the ultimate outcome of civilization, of too much high pressure selling and high pressure buying. Its mother is mass production; its father is modern merchandising. The trouble with some of our modern geniuses of the manufacturing fraternity is that they attempt to reduce human nature to a formula, whereas the truth is that the buyer, like life, is infinitely complex.

"But do they recognize this truth? No, sir. They seemingly take a composite picture of all the potential buyers of the commodity they are to manufacture, and say to their designers, 'Here is the composite buyer. Our analysis shows he wants a machine at a certain price. Design us a machine we can sell at that price.' So out come stacks of drawings and pretty soon a finished machine to fit the price tag arranged to please Mr. Composite Buyer. 'That's fine,' the sale geniuses say. 'By aiming at a composite buyer we may have missed the mark a little, but design some inexpensive selling points into it to sort of throw dust in their eyes during the time of sale and we can land the buyer who really should have a better product and also the buyer who otherwise would not want to pay so much.'

"And, Mr. Riley, that machine over there is the result, but man, oh man, give me that old-fashioned machine born of necessity to meet the actual need of the user, a different machine for every class of user at a price necessary to give him the results he should obtain."

"But," says I, "Are you, the buyer, going to admit any deficiencies on your part?"

"Well, yes, Mr. Riley, now that I'm in a rather crestfallen mood, I think I will confess that inasmuch as I know that orchestra seats usually cannot be bought at balcony prices and that a price tag is the admittance ticket to satisfaction or trouble, I am from now on going to carefully check up differences in value instead of differences in price. The purchase price I pay will be spread over a period of usefulness to get the exact cost, and selling points must be tried out on my job to establish their worth."

"Thank the Lord all manufacturers have not caught the 'price-eat-us' epidemic."

"Yes, and maybe these manufacturers are thankful that all buyers haven't come down with it and that all of them do not have a horse-trading complex."

And so, Mac, as usual, I am passing this on to you, but there is a similarity in John's talk and what John Brundage said the last time he visited us and I believe I wrote you about it.

Yours,

P.G.

P. G. Riley is a former contractor spending his days of retirement under California's sunny skies. Mentally, however, he is almost as much "in the game" as he ever was.

Perhaps his greatest pleasure is in keeping touch with his superintendent, Tom McGovern and, off and on, his secretary, Anna Ryan. His being away from the scene of activity has given P. G. some new viewpoints and he manages, in his letters, to convey to the young folks some of the ideas in the back of his head. One of the bits of advice he has already given "Mac" concerned the wisdom of investigating operating performance when buying equipment. At another time he told Mac of the "catch" in the seemingly attractive trade-in offer. There's a lesson, too, he said recently, in not letting old, inefficient equipment eat up the profits.

In another recent letter "P. G." passed on to Mac a little incident he had heard about, to the effect that horse trading tactics in equipment buying are not the best way of doing business.

Cutting Production Costs *in Products Plants*

A Description of "Casey" Swanson's Products Plant and an Account of the Methods Used to Trim Production Costs—The Factors Covered from This Point of View Are Plant Layout, Equipment Maintenance and Mix Design

By **LYLE BALLANTYNE**
Omaha Concrete Stone Co., Omaha, Neb.

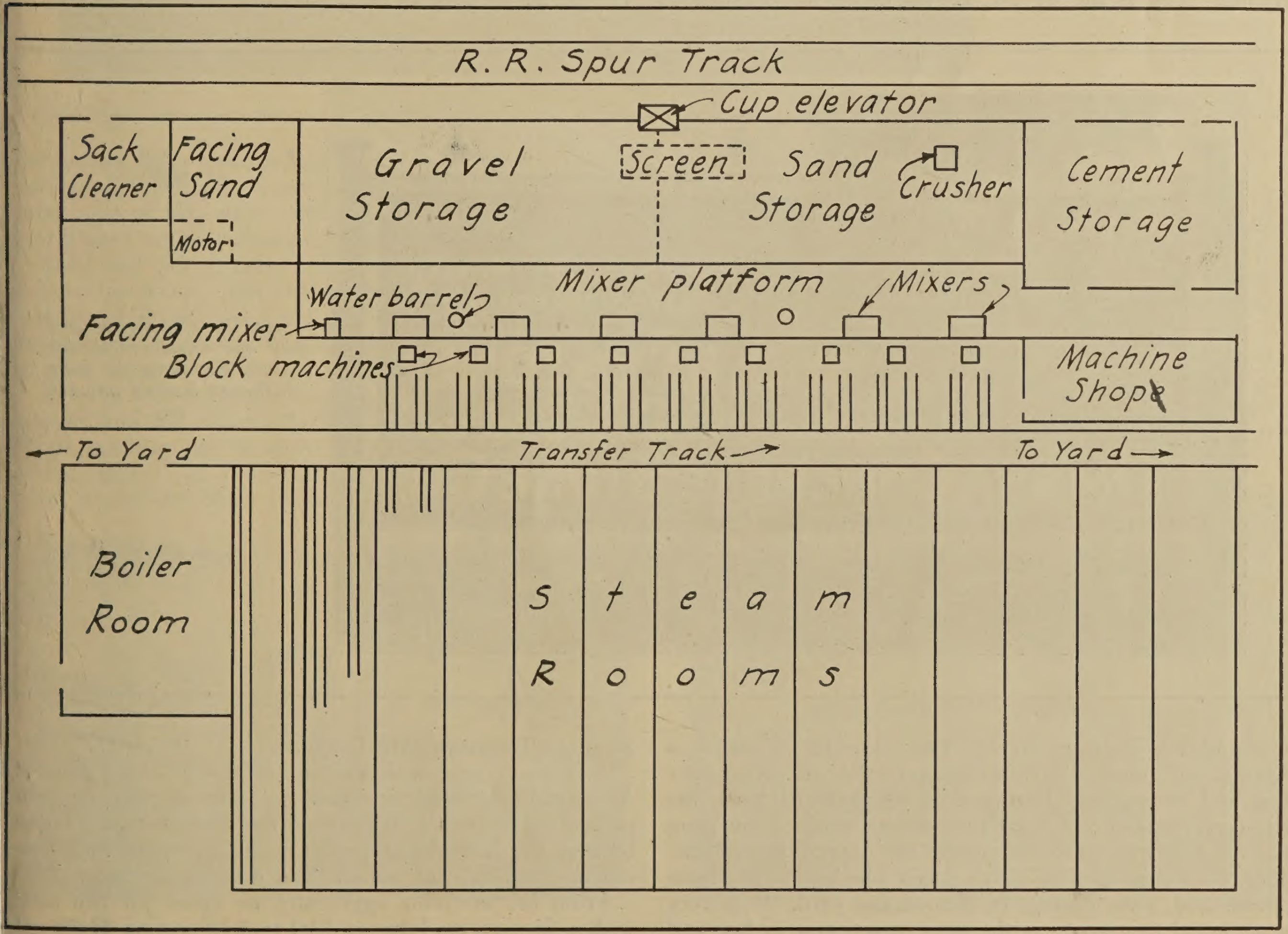
THE factors which have made the Omaha Concrete Stone Company one of the largest products plants in the state of Nebraska with an annual production of over one million units have undoubtedly been similar to those encountered by a great many other products manufacturers who have been in the industry for a number of years. Starting twenty-two years ago with one hand machine operated in a small shed, the company has developed until today it has a capacity which has doubled many times. The company's two yards now have a total of eleven machines and cover three city blocks.

Aggressive selling aided by economical manufacturing methods has enabled the company to market a product whose merit is, today, recognized by all who are in the building industry.

Plant Layout

Development of economical production methods must be worked out for every individual plant, but we hope the plans used in our plant may be of help to others who are using similar materials.

Both the gravel and the pit run sand are shipped to us



Sketch showing the general layout of the plant doubled. When a rush order comes in for special blocks we put 2 per cent calcium chloride in the mix and put the blocks on the job the next day, if necessary.

The stripper type of machine gives an average increase of 20 per cent in production and a direct saving of 10 per cent in molding labor as compared with the old face-down type machine. It also makes the use of a more economical mixture practical as will be explained later.

Proper Maintenance of Equipment Reduces Costs

Labor and equipment costs both offer possibilities of lowering production cost but good equipment properly installed and maintained is one of the best ways of lowering both labor and equipment charges.

Our machine shop, which is not large, has the following equipment: Lathe, planer, drill press, power saw, welding outfit and a set of hand tools. Block and brick machines, transfers and tractors, tampers and ornamental molds are a few of the things which have been made wholly or in part in the shop. The machines which we are using at present for the manufacture of plain blocks are Ideal and Anchor stripper machines with Ideal chain tampers. We have our own patterns for block machine cores and other cast machine parts as well as patterns for block pallets. These parts are all cast by a local foundry. When a mold box and cores become worn the cores are replaced and the side walls of the mold box are relined with a hard grade of boiler plate and we have a machine as good as new which costs a very few dollars for labor and a few cents for parts.

One of the most useful and economical products of our machine shop is the tractor, shown here (No. 1) which replaced the Fordson tractor (No. 2). It is simply a Ford motor mounted between two transfer cars, using only low and reverse and having a direct chain drive on the two center sets of wheels. Patterns were made in our shop for all cast iron parts, including the eight large wheels. This tractor is used to move green blocks to the steam rooms and, after curing, to the storage yard. It is very economical to operate as the gas consumption is low and the only large repair expenses in the last two years have been for five new sets of bands and four new tractor wheels and boxings.

Signs like this were erected by the Omaha Concrete Stone Co. along the main highways leading into the city

Our mixers, which are 14 cubic feet, two blade type, are assembled from parts made locally. Drums are produced by an Omaha boiler works and are made with a removable bottom section which trebles the life of a mixer. Blades and shafts are turned out in our own shop. We found that old tampers, ½ in. by 4 in., could be made into very serviceable mixer blades at a minimum cost.

The plant office

A welding and cutting outfit has such a variety of uses in repairing broken parts that I will not attempt to describe them. New uses will be found, almost daily, when a torch can be used to good advantage.

Savings Through Mix Design

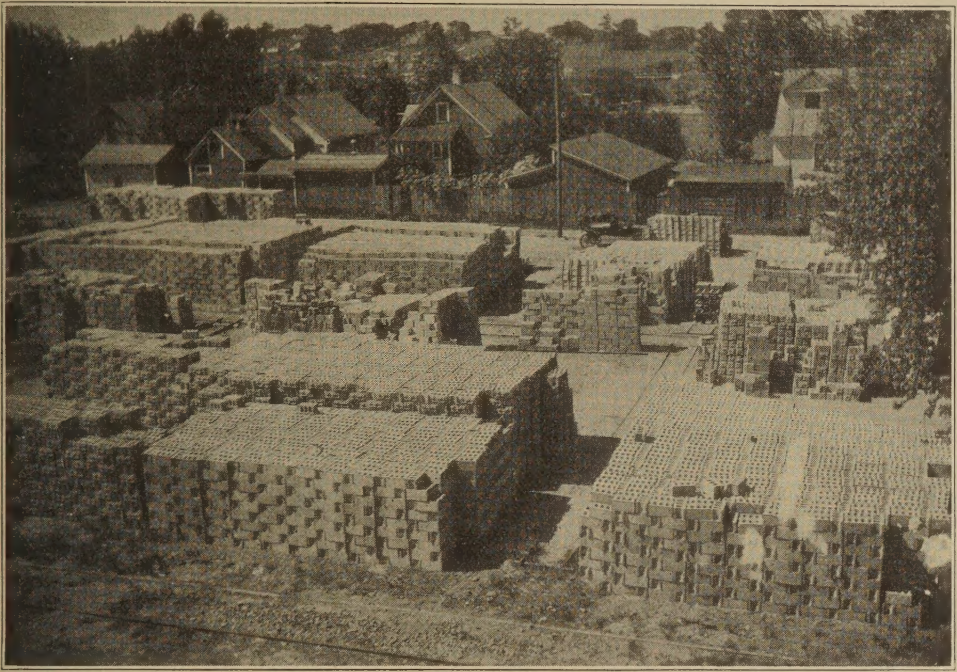
Two years ago, with the aid of the Portland Cement Association, we made an extensive series of tests, the purpose of which was to investigate the fundamental relation between the variables of gradation of aggregate, mix, consistency, curing, time of mix and machine operation.

From the available aggregates we chose pit run sand with a fineness modulus of 3.00 to 3.40 costing $1.20 per ton and road gravel, fineness modulus of 4.90 to 5.20, costing $1.50 per ton. A combination of two parts of pit by the Lyman-Richie Sand Company, in bottom-dump cars which are unloaded into the cup elevator, shown in the sketch. By reversing a chute under the elevator it is possible to fill either the storage pit for sand or for gravel. Each pit has a capacity of approximately 250 tons and they are usually kept well filled in order to keep the material more easily accessible to the mixer men. Cement is unloaded by hand truck from cars through either of the doors into the room marked "Cement Storage." The capacity of this room is about three carloads. From the other side of this room cement is moved by hand trucks and placed beside the mixer, ready for use.

Sand and gravel are moved by wheelbarrow from the pile to the mixer. The amount of each is gauged by the number of shovels used and the mix is checked frequently for cement content and gradation. Complete details of grading, cement content, etc., will be explained later.

After a very thorough mixing, the door of the mixer is opened and the mixture falls to the floor in front of the block machine and is shoveled into the machine by the blockmaker. The blockmaker, who does the offbearing also, places the block on an industrial car which holds 60 ordinary 8 by 8 by 16 blocks. When a car is filled it is moved onto the power-operated transfer and placed in a steam room, where it is cured for forty-eight hours at a temperature of 90 to 100 deg. F.

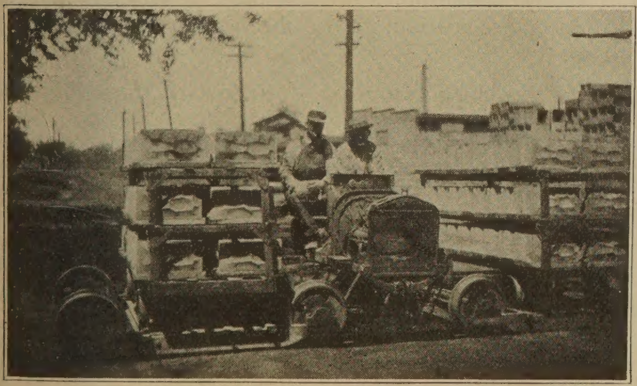
After curing, the blocks are moved on the transfer to the storage yard where they cure for at least one month. We carry a stock of block which runs over 100,000 as this permits thorough hardening of the product.



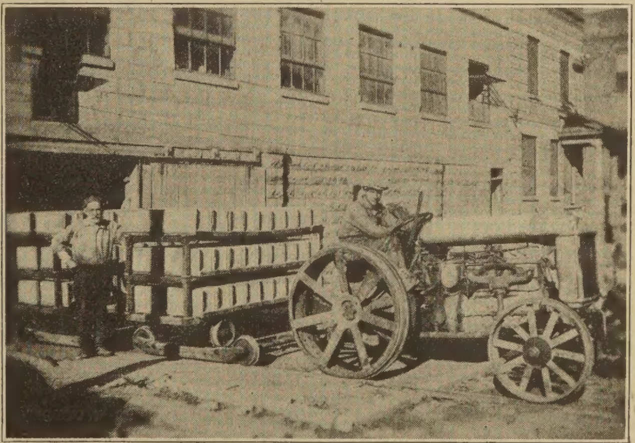
A large yard stock is carried to permit thorough hardening of the block before delivery to the job

Mechanical Equipment

The machines shown in the diagram are as follows: 12-in. Ideal stripper, 8-in. Ideal stripper, 8-in. Anchor stripper, two 8-in. Besser face-down brick machines, 3-in. Ideal stripper, 4-in. Ideal stripper and an 8 by 12 chimney block machine. The 3- and 4-in. machines each produce two slabs in one operation. One man will produce 700 8 by 8 by 16 plain blocks or 500 12 by 8 by 16 plain blocks in one 9-hour day. Ordinarily one man only operates each machine, doing his own offbearing, but when necessary an offbearer is put on and production is nearly



No. 1



No. 2

Illustration No. 1, shows the method now used to transport block from the curing rooms to yard storage. The tractor replaced the device illustrated in picture No. 2 run sand and one part gravel made a mixture with a fineness modulus of 3.80, which was very dense, yet readily workable and produced a block with 50 per cent greater compression strength than one made with pit run sand alone. This method enabled us to keep a fairly uniform mix with a fineness modulus of 3.80, but the big advantage was that we were able to increase the number of blocks made per sack from 18 to 25 without any decline in strength or increase in breakage. Figuring cement at 55 cents per sack, the new sand and gravel mix made possible a saving of 7/10 of a cent per block as compared with our old mix using pit run sand alone.

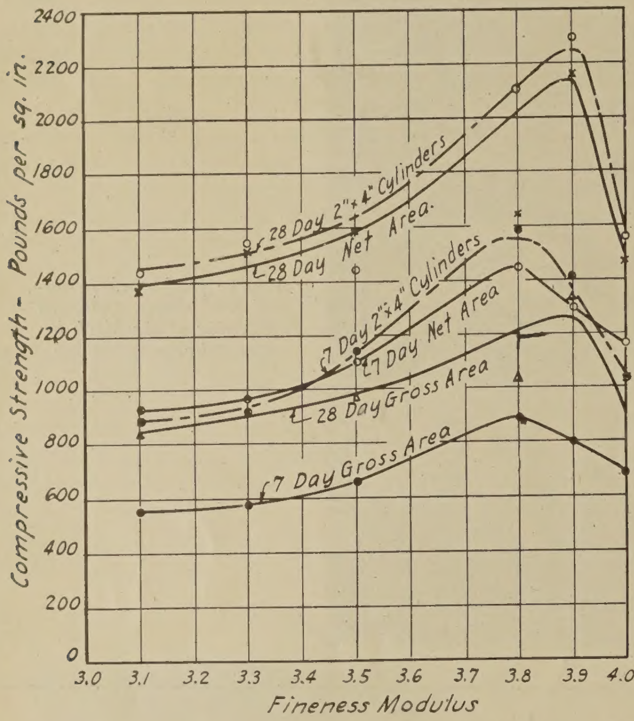


Chart 1. Effect of grading of aggregate on compressive strength. Tests on 8 by 8 by 16 in. block. Aggregate—Platte river sand and gravel. Mix—1:6.2 by volume dry and rodded. Machine mixed concrete 5 min.

In Chart Number One, a constant mix was used which produced eighteen 8 by 8 by 16 plain blocks per sack of cement. Starting with pit sand, more and more gravel was added until the mix became harsh and showed a decline in strength. Having determined the most economical mixture of sand and gravel, Chart Number Two shows the strength that will be obtained from any mix, although it will be found that these values can be increased by using the methods of tamping, curing, etc., outlined in the following paragraphs. The chart also indicates the approximate number of 8 by 8 x 16 blocks which will be produced from one sack of cement.

Other Economies

A water-cement ratio of .98 (7.3 gallons water per sack of cement) was found to produce a mix of good working consistency and showed the highest compression strength of the three tests made. The block made with a dry mix had a 4.32 per cent absorption as compared with 2.80 per cent for the block made with a water-cement ratio of .98.

Five different curing methods showed an average increase of 20 per cent in strength of block cured 48 hours in steam as compared with block cured entirely in air.

In determining the effect of variation in time of mix all batches were mixed dry for two minutes and from four to ten minutes after the water was added. No advantage in workability or strength was shown after five minutes of wet mixing.

Fourteen blows of each tamper foot was the amount of tamping found to produce maximum density. The difference in strength and absorption between a block which had been tamped ten blows and one tamped fourteen was .5 per cent decrease in absorption and 15 per cent increase in compression.

While the information gathered in these tests has been of great value, there are other more economical and better mixes still to be worked out. Recently we tried adding from 5 to 15 per cent of limestone screenings to our mix. There seems to be some advantage in the use of this material, but as yet we have not reached any conclusion. We hope our experiments will point the way to better quality and greater economy for the block manufacturers who realize the necessity for more economical manufacturing conditions.

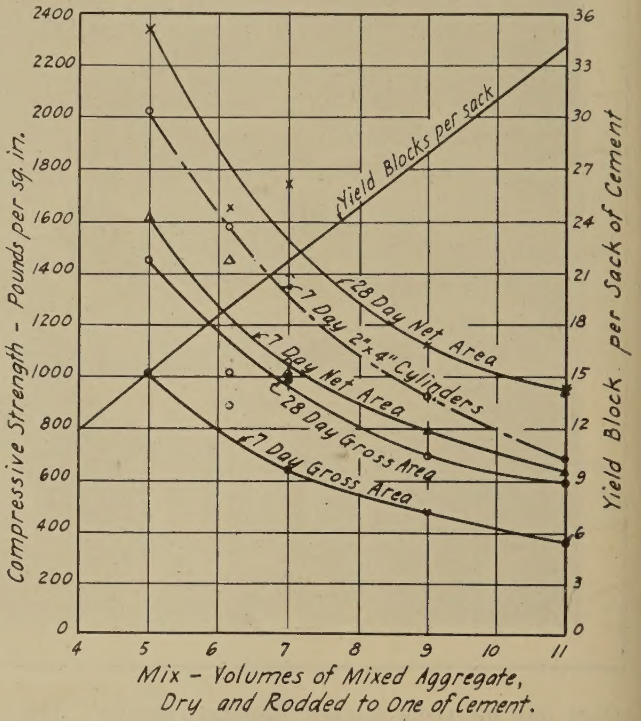


Chart 2. Effect of quantity of cement (mix) on compressive strength. Tests of 8 by 8 by 16 in. block. Aggregate—Platte river sand and gravel, constant gradation. Machine mixed concrete 5 min. Cured 48 hours steam (95 deg. F.), remainder in yard (75 deg. F.)

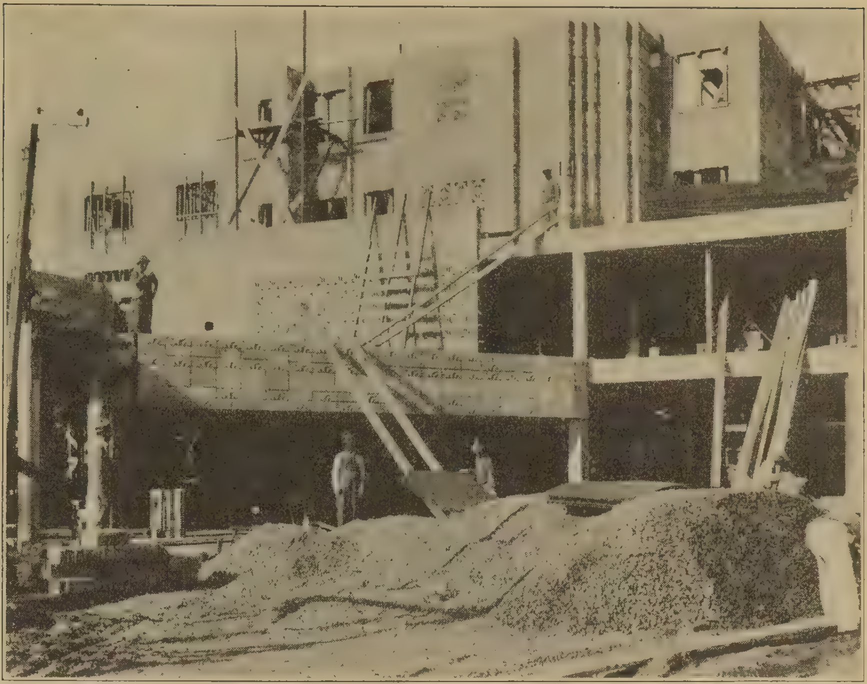
"Casey" Swanson, secretary of the National Concrete Products Association, guides the destinies of this efficient plant.

Table Showing Fineness Modulus of Materials Used

Size of screen	Commercial pit run sand, per cent retained	Commercial road gravel, per cent retained	Mixture 2 parts pit sand 1 part road gravel, per cent retained
100	99	100	99
48	87	98	90
28	62	93	74
14	38	88	58
8	18	80	40
4	5	40	17
3/8	1	9	6
3/4	0	0	0
Fineness Modulus	3.10	5.08	3.84

Textile-Block Slabs

as used by
Frank Lloyd Wright



In Building New Arizona-Biltmore Hotel

By ROY GEORGE

IN constructing the Arizona-Biltmore hotel, near Phoenix, Arizona, more than 250,000 textile-block slabs, invented by the internationally known architect, Frank Lloyd Wright, were used in the main hotel and the fifteen cottages. Of the many features that contribute to the beauty of the $2,500,000 hostelry, this new use of concrete is easily granted first place, and no sacrifice in strength or durability has been made in attaining this new and outstanding architectural charm. Resistance tests, devised from every angle, show that strength and durability are decided features of the block.

Showing one of the metal molds used in making the textile block. Pneumatic hammers were used to tamp the concrete

These blocks, molded by the dry-tamp process, provide a subtle means for aesthetic expression in addition to being the least expensive and most expedient medium for permanent construction. The great artistic advantage of textile-block is that by means of designs molded on the face of the blocks, an effect in light and shadow is attained that has to be seen to be appreciated. Color may be used in the mix, and while it was not used in the present instance, yet the effect of the shadows gives a blue cast to the entire facade, a very kind light to the eye in the desert setting.

How the Block Are Made

The designs on the blocks are first built up by hand in modeling clay. Plaster of paris casts are then made, and from these the metal molds into which the concrete is tamped by air-controlled rams are formed. More than 24 different sizes and shapes were employed in the Biltmore job.

The thickness of the blocks is uniformly four inches at the edge, but they are cut away in the center until the thickness is approximately one and one-half inches. The hotel is constructed of double walls with a four-inch air space between. The blocks are strung like beads on vertical steel rods. The stringing works out well in actual construction and the workmen soon get the knack of it.

The real triumph is in the appeal that is made by the immense decorative panels of this new masonry when it is completed. The effect is that of a new building material, something lending itself naturally to massive construction but with new values in the delicate filigree tracery that affords the high lights in the architectural decoration. The slabs used to outline the building and relieve the plainess of smooth walls bear on their face a design that at first glance suggests modernistic art, but on closer examination appears to be of native Indian adaptations. Sharp angles protrude and there are no curves, but a fine

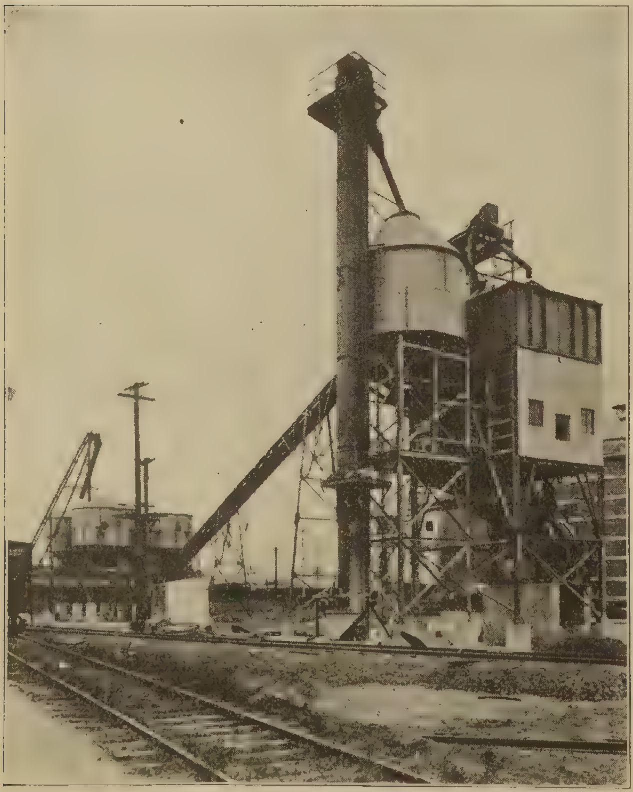
The special block in stock, ready for use on the Arizona-Biltmore Hotel

harmony is worked out between blocks of different design and between the smooth and rough-faced slabs.

Two more large buildings are under way in the Phoenix district in which these new blocks will be used.

Ready Mixed Concrete Plant at Cincinnati Economically Designed

Cincinnati, Ohio, is the location of one of the hundred central mixing plants operating in the United States at this time and the design and operation of this plant as an efficient, economical unit has evinced a good deal of interest.



The central mixing plant of the Avril Tru-Batch Concrete Co., Inc., at Cincinnati, Ohio

The Avril Tru-Batch Concrete Company, Inc., ready-mixed plant, shown in the accompanying photograph, consists of four 18 ft. diameter circular bins, each having a capacity of 196 tons, one 15 ft. diameter cement bin having a capacity of 110 tons or 587 bbl., one 200-ton 4-compartment batching bin, one bucket elevator, one belt conveyor, one enclosed elevator and a 2-yd. mixer.

The four circular bins are used for storing the aggregates—sand, gravel and crushed stone. The use of these bins for storage, instead of the "stock-pile" method, prevents segregation and as a result maintains the gradation of the aggregates, thus allowing the concrete to be designed on a "fineness modulus" basis. When such a design is used in combination with water-cement ratio control the strength and quality of the concrete is assured. The coarse aggregate are graded in three sizes. By recombining these separated sizes for the successive batches, any gradation of coarse aggregates may be had.

The aggregates are conveyed from the four storage bins to the batching bin by a belt conveyor. The batching bin is equipped with 4 single weighing batches. These weighing batchers are accurate to the pound and each batcher is equipped with a separate scale whose reading beam is enclosed in a box. Each scale is equipped with a dial which weighs the last 200 pounds of each batch. This insures the operator against having an over-run and speeds up the operation.

The cement for the concrete produced at this plant is delivered in bulk in railroad cars. The cement is conveyed from the cars to the circular bin by means of an enclosed bucket elevator. The cement bin is a 15 ft. circular bin with a steel cover and has a side discharge bottom hopper. It is equipped with a weighing batcher, having a separate scale whose reading beam is enclosed in a box. This scale also carries an auxiliary dial. The batcher discharges on a belt conveyor which conveys the cement to the batch hopper in the mixer.

This plant does not require expert or skilled labor for operation and to produce the maximum output of 60 yd. per hour requires only four laborers and one foreman. These men unload the aggregate cars, charge the batching bin, unload the cement cars, batch the aggregates, operate the mixer and load the trucks.

The Blaw-Knox Company, Pittsburgh, Pa., designed, engineered and fabricated the plant.

~ EDITORIAL ~

High Early Strength Cement

IN a recent paper presented at a meeting of the Engineers' Club of Philadelphia, H. S. Mattimore of the Pennsylvania Department of Highways, said:

"... within a short period an insistent demand for specifications to govern the quality of special cements will be presented by the consumers; in fact, it looks at the present time as if we were rapidly approaching the stage of at least two specifications for portland cement, with the possibilities of a third. I can see no objection to the existence of such specifications, in that, if the product is made and marketed, it is desirable for all parties concerned to have some specifications to govern the quality."

It is natural that a movement of such vital importance to the concrete industry as the formulation of another or of two more standard specifications for cement should be approached carefully and cautiously. But now high early strength cements have been on the market for some time and enough is known about them to permit the formulation of a tentative specification which still can be modified if later developments indicate that it is advisable to do so.

The need for standardization is as urgent today as it was in the early history of the cement industry before the first standard specification was adopted. Without a standard covering high early strength, the present already pronounced trend toward numberless "home-made" specifications will work hardship on the entire industry.

There are indications that action in this direction may be expected. It should not be delayed beyond the time required to accomplish the purpose constructively. Users of cement can do much to encourage this movement by expressing opinions for, in the last analysis, it is the user who determines the type of product that will be manufactured for him.

Central Mixing Plants

FEW developments in the concrete industry have forged ahead as rapidly as central mixing plants. There is much to be said in favor of them and their rapid growth is possible only because they meet a definite need.

Much has been published regarding central mixing plants. Most of the material that has appeared has been written primarily from the engineer's point of view and has emphasized the concrete control advantages that can be secured with the use of central mixing plants. Only occasionally have criticisms appeared and warnings regarding the use of centrally mixed concrete have usually been overshadowed by accounts of those features that are recognized as being distinctly favorable.

Yet, a subject of this kind must have two sides. It would, for instance, be interesting to know the contractor's viewpoint. Is the contractor as enthusiastic about the use of centrally mixed concrete as the engineer is? Is he satisfied to abandon that portion of his operations and equipment devoted to aggregate proportioning and mixing? Does centrally mixed concrete always meet his requirements as fully as does the concrete mixed in his own plant? Many concrete contractors have learned to control the quality of concrete accurately and they have taken advantage of the economies that are possible in the use of quality control methods. These have become of value to the progressive contractor from the standpoint of merchandising his services.

There is, also, another angle from the contractor's point of view. Probably the greatest problem that now confronts him is the irresponsible contractor, whoever or whatever he may be. Contractor's organizations are lending every effort to solve that problem. One of the evils, they say, is the ease with which inexperienced and financially irresponsible men can get into the contracting game. Will the central mixing plant aggravate this situation by making it unnecessary for the new concrete contractor to invest in aggregate handling and mixing equipment and labor?

These questions should not be construed as arguments against the central mixing plant. They are not presented as such. They are merely asked because they are angles that should be considered in connection with the subject of central mixing plants, if the further development of this new, helpful tool in the concrete construction industry is to continue in a constructive manner.

What Is Concrete Masonry?

CONCRETE masonry has been defined as "block, brick or tile building units molded from concrete and laid by a mason in a wall. The concrete is made by mixing portland cement with water and other suitable materials such as sand, pebbles, crushed stone, cinders, burned shale or slag."

All such units, regardless of the particular type of aggregate used, are concrete masonry. Each manufacturer benefits in direct proportion as ***concrete masonry*** is accepted by the architect or builder. The material ***as a whole*** must be accepted generally before each particular type of unit can realize its full sales possibilities.

From the Products Associations' Bulletins

Wisconsin Concrete Products Association

JACK FRANKLIN, Secretary

A ONE-PAGE news letter over the signature of the Wisconsin association's field engineer and released on May 2nd makes announcement of the radical reduction of insurance rating on concrete masonry in many states as the result of team-work between the Portland Cement Association and the Underwriters' laboratories.

The association's monthly "Digest" for April reproduces on its cover the 1929 home show exhibit of Wm. H. Devos Co., Inc., of Milwaukee. The first article is devoted to a recent Milwaukee Home Show, at which the Devos exhibit was used.

"The exhibit," the Digest says, "was much better than is shown in the picture, which does not do the exhibit justice. The Devos Company stressed their new concrete roofing tile, at the same time showing their block to good advantage."

Asked for his opinion of home exhibits such as his company had participated in, Arthur Devos is quoted as saying "We made many contacts and are selling jobs that we never would have known about if we had not had an exhibit. I think that we will still feel the effects of our exhibit, as far as selling is concerned, five years from now."

Other exhibits that are also described and pictured are those of the Economy Concrete Products Company and the Cincrete Products Corporation, and A. W. Friske.

The Economy exhibit covered two spaces and displayed their new A-Lyte unit. Results were of such proportions that reservations for space at the next home show have been made. The Cincrete exhibit was also of good proportions, and the Friske display boasted a modernistic background.

A short item reports, "A little incident, that while small, was gratifying, has come to our attention. Granite Concrete Stone Company, Milwaukee manufacturers of concrete products, called us and stated that their envelope did not contain a Digest and since they looked forward to receiving the Digest and read it from cover to cover, they wanted us to mail another."

Upstaters are given what is acknowledged to be some well-deserved publicity on the page headed "Through the State."

Iowa Concrete Products Association

R. L. GAVIN, Secretary

THE definition of concrete masonry is the first subject undertaken in the May issue of the Iowa bulletin. It is suggested the products manufacturer answer the inquiries of architects, builders, home owners and others with the Portland Cement Association's definition that "The term 'concrete masonry' is applied to block, brick or tile building units molded from concrete and laid by a mason in a wall. The concrete is made by mixing portland cement with water and other suitable materials such as sand, pebbles, crushed stone, cinders, burned shale c slag."

Then follows the balance of a Cement Association communication stating that, "A two-page advertisement, t appear in a number of national magazines reaching th home owner and the prospective home builder, feature this definition. This is part of our educational campaig to acquaint the public with the meaning of concrete masonry construction, what the units are made of and thei advantages.

"It is to the interest of every concrete masonry manufacturer to adopt this definition word for word and broadcast it in as many places and as often as possible. I should be used in local advertising, in literature, on blo ters and calendars and even on stationery. When you o your salesmen call on an architect, a contractor, a realto or a prospective builder, be sure that he knows what i meant by concrete masonry."

Under a paragraph entitled "Your Advertising Shoul Have Punch," the products association offers to suppl copy suggestions that may be used in local newspapers t tie up with the Cement Association advertising. This feature of tying up individual plant advertising is reported, i the bulletin, to have already been taken advantage of du ing April by a number of manufacturers.

Then appears the following, as reprinted from an advertising house organ:

"Attention, Interest, Desire! How many times glancin over advertisements has your mind taken these three step toward the decision to buy, yet balked when led to th step of conviction and action? You would not, or coul not, sign on the dotted line. You want so many things, bu your income compels you to turn away.

"Clever layouts catch the reader's attention and awake his interest; enticing copy lures his desire. Continually h is repeating this process unconsciously as he turns throug his newspapers and magazines. One bold ad shouts "BU ME," another alluringly whispers, "Buy me." Each ad, i competition with others, clamors eagerly for the reader' favor.

"But the reader has but few favors to bestow. Like th woman with many suitors who can marry only one, h must choose what he shall buy."

Farther on in the bulletin are found two suggestions fo advertising copy.

The importance of recognizing the local fire marsha and fire chief as "important cogs in your machinery fo the promotion of concrete masonry construction" i stressed in this issue of the bulletin also. To continue "These men are looked to by the city council for advic regarding fireproof materials and if they are acquainte with concrete masonry your products will have prope classification in the building ordinances. Testimonia letters and other communications from these men will hel you sell products and you should use them to the limit."

The local honor roll, comprised of products manufacturers in Iowa whose block qualified in tests, is as ye limited to two names, and others are urged to interes themselves by selecting samples and sending them in fo testing.

Concrete block were used to construct the airplane hangars at the Municipal Airport, Cleveland, Ohio, shown above

The Need for Permanent Improvements at Airports

Aviation Develops New Opportunities for Concretors—Why Concrete Structures Are Needed—Some Examples and Opinions Regarding Them

By E. K. SMITH

PERMANENT construction is necessary at modern airports for several reasons:

Grading and draining an area approximating a square mile is expensive and laborious. It is a far more responsible job than draining a golf course where players are barred off when the greens are not in shape, and demands the best engineering skill. The sewers must be adequate to handle heavy storms and the system must collect surface water as soon as possible. Other underground pipe lines and services should be planned and installed so that flying service need not be interrupted for addition or alterations underground.

I am confident that your experts in lighting and field control feel that this applies with equal force to their installations, even though improvements are to be expected.

For buildings, masonry construction has unquestioned advantages. Whether of solid concrete, concrete block or

This is the Union airport at Glendale, Calif. It has a concrete runway 72 ft. wide and a 25-ft. drive along the hangars. The first unit of an administration building of concrete has also been completed

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Based on a paper delivered by E. K. Smith before the First Annual Airport convention under the auspices of the Airport Section of the Aeronautical Chamber of Commerce, at Cleveland, Ohio, May 16th.

tile, brick, etc., upkeep is low, yearly repairs are not necessary, and the heavy expense of heating in winter is greatly reduced. Fireproof masonry construction lessens the risk from fire loss and results in lowered insurance rates.

The airport is the home of the so-called infant aviation industry, and it's a pretty husky infant and demands a good home.

First Impressions Count

Commercial aviation has just one thing to sell—transportation service—with one principal advantage—speed. Flimsy or makeshift accommodations and devices for handling mail, passengers or express on the ground, to or from the plane, may seriously affect the time-saving factor that is your great selling point.

The airport today is your greatest point of contact with the general public and has the greatest effect in creating the impressions that remain in the public mind. Most people know little of the finer details of the planes. Ten years from now, they may have as much confidence in planes as in automobiles, but the business of aviation must be built up today.

What idea of the industry does an airport make on Mr. Average Businessman, who has never flown, when he drives out to take a look at it? Does smooth pavement lead onto the field, for cars, buses, and mail and express trucks, as he is used to seeing at other express terminals? Is there a convenient parking place? Are there sidewalks underfoot, and grass plots adjoining? Is there a comfortable waiting room with suitable toilet facilities? Are the buildings a miscellaneous collection of rough, barn-like structures, or are they good-looking, dignified, the first section of a well designed plan for the improvement of the entire field? Do the planes land in dust or mud or on good turf or smooth pavement?

If it is a busy municipal airport, 5,000 to 50,000 people will frequently visit it on pleasant days. They are as much entitled to provision for their comfort as in any park or place of public gathering. If this consideration is not shown them, there may be an unfavorable reaction when the taxpayers are asked for airport funds. The luxuries of yesterday are the necessities of today. The impression left with these thousands of visitors and the newspaper comments are more effective than the advertising for which air operators spend many thousand dollars per year. The airport should at a glance appear to be the dignified terminal of an important transport industry. The buildings and grounds should give the impression of an important, businesslike, stable and permanent industry. Even the smaller factories and public garages recognize the business value of a good appearance. The modern airport must *sell* the business of aviation to every visitor. Railroad and union bus terminals have capitalized on their appearance and convenience for years. There are far greater opportunities at airports while aviation still holds the public eye.

Plan for the Future

Any plan must, of course, be flexible and open to change for the better as new developments take place. Yet if the original design for the airport is broad enough, changes may still be made in harmony with the general scheme. A factory may buy improved machines to replace others only two years old, in fine condition. If the new machines show a respectable net saving in production costs, it is the cheapest thing to do. Traffic at an airport may soon increase so far beyond our dreams as to render obsolete some of the early improvements, yet this is no argument against the early improvements, if planned with the best judgment available. These early improvements are rather to be regarded as an investment, without which the industry could not have developed so rapidly. Flimsy, crude, temporary, structures would retard the development, and delay public confidence.

There are some eleven hundred municipal airports in the United States and several hundred more in private ownership. The greater number are new and very little developed. Some are handling air traffic up to their capacity at the present time. How much traffic will there be in three years or five years? Three times as much as today? Would not ten times as much be a better estimate? Two or three thousand planes were manufactured in 1927, five thousand in 1928; the factories are expanding for a production of 10,000 in 1929, a rate of growth far faster than that of the automobile industry in its early years. And, just as the automobile could not be produced in quantity until there were improved roads all over the country on which to use them, so the growth of the airplane industry depends on the provision of improved airports all over the country. A 10,000-lb. transport plane making a demonstration flight to Illinois cities just the other day had to be hauled out of a wet field by a tractor before it could find a place to take off. Several times in the last three months planes carrying government air officials have been reported as turning over on soft or deeply rutted fields. Nearly every government air bulletin lists certain airfields as unsafe for landing, in whole or in part. The best of our airports today are in private hands. The capital of the United States up to this month was without direct air mail service, for lack of an airport.

Construction of a durable, permanent nature is not expensive, especially as compared with the benefits received. The airways are free, with lighting and control furnished by the national government. The construction of a system of intermediate state marked and lighted airways, is now proposed in New York. The cost of good, firesafe buildings and other ground improvements is small compared with the investment in airplanes to use the port. The growth of this feeling is evidenced by improvements now under way at many United States airports.

Some Modern Airports

In February a million dollar union airport was opened at Glendale, California, by C. A. and C. C. Spicer, to serve western air companies and the Transcontinental Air Transport. An elaborate and complete administration building of concrete was planned and the first unit is completed. A 25-ft. concrete paved roadway or taxiway runs along the hangars and joins the concrete take-off runway, 72 ft. wide by 3000 ft. long. The remainder of the field has been oiled to lay the dust. As illustrated, the main building is not expensive, but compare its durability and appearance with the light buildings on some airfields.

The main building at the Alameda, California, airport, just completed, is a handsome concrete structure. Concrete pavement several hundred feet long keeps both planes and passengers out of dust and mud. Similar construction is going on at a number of other fields in the West. Kansas City built concrete drives and taxiways last year at its municipal airport and is building more this year.

The new Pan-American Airways terminal building at Miami serves also the immigration and customs services. It is of serviceable construction, concrete tile and steel, finished on the outside with cement stucco suited to the Florida climate.

Buildings of the small fields need be no less carefully built. The concrete block hangar at the University Airport, Austin, Texas, is one of the simplest designs for durable construction. Another at Wichita, Kansas, has increased window space and more trim on the front. There are concrete block hangars of similar construction at Cleveland, one of the busiest airports in the United States, and a contract was recently let for 40,000 sq. yds. of pavement on the field. A concrete, stucco-covered showroom, hangar and gas station at the Dennison Airport, near Boston, Mass., shows the possibilities of design for an airport building. A building of dignified and substantial appearance is on Donald Woodward's private airfield at Le Roy, New York. During the past year this concrete and steel building housed the "Friendship."

The Ford Airport

One of America's most notable airports is unquestionably the Ford airport at Dearborn, Michigan. This serves as factory, testing ground and port. It is spoken of as an experiment and a hobby, but, like some of the other Ford "experiments," it shows indications of becoming a "hobby" that returns a profit. The passenger station is certainly popular, and this port had the distinction last year of placing in service the first concrete runway for landing and taking off. A thin surfacing on an ordinary field cannot be expected to satisfactorily support during all kinds of weather a wheel carrying a load from the plane of from 5,000 to 20,000 lbs.

Stanley Knauss, manager of the Stout Air Services, recently stated in an address before the Michigan Engineering Society, "From the grass fields we have come to the concrete runway. We have gone through the same stages that the road builders have. We had cinder runways, gravel runways, crushed rock and now we have the concrete runway that is a known quantity every day in the year. It gives us the ability to get off quickly and land safely."

Concrete Construction Affects Plane Efficiency

Commercial planes are increasing in weight all the time, and the example of the Ford airport has been followed by the construction of concrete runways to carry the heaviest part of the field traffic at Glendale, California, and the new municipal airport at New York City. A second concrete runway is now under construction at the Ford airport. Mr. Stout recently made the statement that general use of concrete runways would enable smaller tires to be used on the landing gear, and cruising speed of the planes to be increased at least five miles an hour, because of decreased air resistance.

The United States government is planning good building drainage and pavement at army airports to replace the temporary (but expensive) buildings of war time construction. The last Congress authorized appropriation of over $5,000,000 for improvements at 25 military fields in all parts of the United States, Hawaii and Panama. March Field, at Riverside, California, will be one of the best equipped fields in the United States. Durable concrete construction is planned throughout for buildings and pavement, and much is already completed. The hangars are roofed with cement tile to make them truly fireproof. The entire development is expected to cost in the neighborhood of $5,000,000.

An indication of the interest which is felt in airports is the contest announced by the Lehigh Portland Cement Company of Allentown, Pa. Ten thousand dollars in prizes are offered for the best designs for modern airports. The committee in charge includes Dr. George Lewis, Porter Adams, Col. H. H. Blee, Major John Berry and Col. Paul Henderson.

European air passenger traffic is quite highly developed today, and it is said that their airports have played an important part in developing public interest and confidence. Such are the English airport at Croydon, with long concrete drives and taxiways and buildings of precast concrete stone—the well-paved Tempelhof field, serving Berlin, the Roman "Littorio" airport, where reinforced concrete and steel hangar can house 200 planes, and which has a hotel in addition, and the huge concrete dirigible hangar at Orly, France.

An Opportunity for the Concrete Industry

After a transcontinental flight last year, W. D. Longyear, treasurer of the American Bankers Association, made the following statement:

"Anyone who has made a transcontinental airplane trip, such as I am about to complete, cannot help noting the uneven way in which our air transport industry or business is developing. Right now the air end of it is ahead of ground equipment—landing fields, airports, housing facilities, lighting and all those things which enter in this new but tremendous industry. This should not be. The development and improvement of airports must quicken pace and continue to speed up. It is necessary to the proper progress of the entire industry that the ground phase not only keep pace with improved planes, but keep a step ahead. Manifestly no city may expect to share in air transport advantages that does not have an adequate airport. That must come first, otherwise the planes and the business they represent to any community will pass over."

There are well constructed buildings and concrete paved driveways at Ford Airport, Dearborn, Mich.

The size of commercial planes and their pay loads are rapidly increasing. The commercial air companies are continually rendering better, speedier and safer service, and deserve widespread public use. At present the airport is the important point of contact between the general public and the air industry. The immediate development of this industry lies very largely in the hands of those responsible for the airports.

Society to Determine Effect of Concrete on Steel

The Western Society of Engineers, Chicago, Illinois, has embarked upon a program of determining the effect of concrete floors and fireproofing on stresses in steel framing. The few previous tests made to this end by other investigators, disclosed after exhaustive research of literature, indicate conclusively that there is a definite increase in the strength of steel beams, added by the concrete encasement ordinarily supplied for fireproofing.

A committee appointed by the society will conduct a complete test on a typical steel structure.

Testing Society Convenes At Atlantic City June 24th

The total number of items on the Provisional program of the American Society for Testing Materials, to be presented at the annual meeting on June 24th to 28th exceeds in number that of any previous annual meeting. The gathering will be held at Chalfonte-Haddon Hall, Atlantic City, New Jersey.

Opening Meeting

The general opening session will take place on Tuesday afternoon, the 25th, at 2 o'clock. Immediately following it, the second session, on nomenclature, research and methods of testing, will be held. The opening report, that of Committee E-8, on Nomenclature and Definitions, to be presented by Cloyd M. Chapman, will report progress in correlation of definitions of terms. W. H. Fulweiler, chairman of Committee E-1, will give a report on methods of testings. At the same session the results of tests on tension, bend and impact on reinforcing bars will be reported by W. A. Slater.

The sixth session, scheduled for the 26th, will open with the report of Committee C-7, on lime, of which H. C. Berry is chairman. It will be followed by another on concrete pipe, constituting the report of Committee C-4, G. T. Hammond, chairman.

Concrete Specifications

Preservative coatings for structural materials will be the subject of report of Committee D-1, Allen Rogers, chairman, which will be presented at the morning session of June 27th. Another schedule for this session is report of Committee D-4, on road and paving materials, of which R. W. Crum is chairman. It will present new specifications for portland cement concrete for pavements and pavement base. It will present as tentative revisions of three standard specifications, the revision of two tentative standards and the advancement to standard of five tentative standards.

The next session of particular interest to concretors is the twelfth, to be held on the 27th and concerning principally mineral aggregates. It will open with a paper by R. W. Crum, entitled "Introduction and Organization for Inspection," followed by one by A. S. Rea on methods of inspection of mineral aggregates. H. F. Gonnerman will present a paper on fine aggregates in concrete, discussing generally the function of the fine aggregate in concrete and the significance of properties and tests, followed by a paper by J. C. Pearson on fine aggregate in mortar and plaster.

Subject of Mineral Aggregates

The thirteenth session will be a continuation from the preceding one and will be held simultaneously with the fourteenth session. It also will concern mineral aggregates, commencing with a paper on the influence of quality of coarse aggregate on the strength of concrete, by F. C. Lang. Mr. Lang will discuss data covering such properties as hardness, toughness and resistance of wear of aggregates now in common use. He will include conclusions on the effect of various characteristics on both the compression and transverse strength, considered separately.

The fifteenth and concluding session, on June 28th, will be devoted exclusively to cement and concrete. In brief, the program at this time will include papers on the following subjects: Report of Committee C-1, on Cement, P. H. Bates, chairman; "Rate of Hydration of Cement Clinker," by F. D. Anderegg and D. S. Hubbell; "A Compression Test for Portland Cement," by O. L. Moore; "Effect of Certain Powdered Admixtures in Concrete," by D. A. Abrams; "The Tensile Autogenous Healing of Portland Cement Mixtures," by H. J. Gilkey; Report of Committee C-9: On Concrete and Concrete Aggregates, by Cloyd M. Chapman, chairman; "New Procedure of Proportioning and Testing in Concrete Research," and "Sugar in Sand: A Quick Test to Determine Its Presence Bacteriologically," by N. H. Roy. R. E. Davis will present the closing paper, "The Effect of Age and Other Factors Upon the Modulus of Elasticity and Poisson's Ratio of Concrete."

Engineers Make Progress Report on Detroit-Canada Tunnel

For a length of 300 ft. the excavation and concrete structure of the Open Cut subway located within the Detroit Terminal area on Randolph Street, Detroit, Michigan, are rapidly nearing completion, and the excavation is under way for 320 ft. more. The concreting of this section will proceed at a very early date. The subway will terminate at Windsor, Ontario, Canada.

Two hundred twenty feet of 466 ft. of Shield-Driven tunnel, extending from Atwater Street to the Detroit River has been driven. The invert of this section is from 50 to 65 ft. below the street surface and the present rate of progress is approximately 8 ft. per day.

Four of the ten steel and concrete tubes for the river section are in process of construction. Three have been launched; the fourth will be launched at an early date. One tube has been completely concreted and is scheduled to be sunk by June 1st and two more will be ready for the beginning of the sinking operation within two weeks.

Work has commenced on the Windsor Open Cut approach section and is proceeding rapidly.

The tunnel is being constructed for the Detroit and Canada Tunnel Company. Parsons, Klapp, Brinckerhoff and Douglas are engineers for the project. Porter Brothers and Robert Porter, of Spokane, Washington, are general contractors for the Shield-driven and River sections. Parklap Construction Corporation of New York are general contractors for the Open Cut sections, terminals, ventilation buildings, machinery, equipment, etc.

The Shield-driven sections have been sublet to the Northern Construction Company, Ltd., of Montreal; the Canadian Bridge Company of Walkerville, Ontario, is constructing the steel tubes. Whitney Brothers of Duluth and Detroit have the sub-contract for placing the tremie concrete and sinking the tubes. B. Sullivan Dredging Company of Detroit hold a sub-contract for the dredging work. The Mark R. Hanna Company of Detroit have the sub-contract for construction of the Detroit approaches, and the Spencer, White and Prentis Company, of Detroit, have the sub-contract for the Windsor approaches.

University Correspondence Course in Concrete-Making

The Extension Division of the University of Wisconsin, College of Engineering, at Madison, has announced a correspondence study course on practical concrete work especially to meet the needs of the small contractor and concrete worker. The course consists of 12 assignments and a few of the subjects included are proportioning, mixing, placing, waterproofing, forms, and estimating and field work.

How to Remove Stains
from Concrete

A Compilation of Detailed Instructions for Removing Various Kinds of Stains from Concrete Surfaces

WHILE practically every type of stain can be removed from concrete without appreciable injury to ither the texture or color, the eradication of old stains which have been long neglected may require considerable patience. Stains from oils which have penetrated deeply and oxidized in the concrete are probably the most stubborn of all. In such cases it is a matter of repeating the reatment day after day until the desired results are atained. It is not always possible to determine what the taining matter is, and hence the treatment sometimes has o be a matter of experimentation. Usually the staining matter will be found to exist in a stable form, and its removal may require several applications of a solvent which does not appreciably affect the surface. A considerable ariety of chemicals may be applied to concrete without ppreciable injury, but acids or those chemicals which develop an acid condition should be carefully avoided. Even weak acids, such as oxalic and acetic, may show their ffects on the surface if left on concrete for a considerable ength of time.

Kinds of Treatment

Usually stains can not be readily removed by merely pplying the proper chemical to the surface or by scrubbing the stained part. This is due to the fact that stains penetrate to some degree and can not be reached by the mop. In general, it is necessary to resort to a poultice or bandage. By a poultice is meant one or more chemicals mixed with a fine inert powder to a pasty or mortar conistency. This is applied to the stained part of the conrete with a brush or trowel in a layer of considerable hickness. The bandage treatment consists of soaking a ayer of cotton batting or a few layers of cloth in a chemial solution and pasting this over the stain.

There are two ways in which a stain may be eradicated, first to dissolve the staining matter and draw it out by apillary suction or drive it back from the surface; and, econd, to convert the coloring matter by a chemical eaction into a form which does not show as a stain. In emoving an oil stain it is usually necessary to apply a olvent and draw the dissolved oil out. An iron stain is more satisfactorily treated by applying a reducing agent. Evidently in this case the stain would reappear in time nless means were taken to prevent the reoxidation of the iron. This is readily accomplished by an application of odium citrate solution. Some chemicals used for removing stains are very unstable and decompose under certain onditions. Such chemicals sometimes produce stains of heir own which may be more troublesome than the orignal. This is particularly true of the hydrosulphite $\mathrm{Na_2S_2O_4}$) used in removing iron stains. A method for sing this chemical is described under the subject of iron tains. This has proven entirely trustworthy, but unless he procedure is rather closely followed one may obtain a ellow stain. If the poultice is left on several hours a lack stain may develop, which is probably due to the ormation of a sulphide of iron.

Some staining matter is easily dissolved by a surface scrubbing and apparently removed, but as the area dries the stain may reappear. Tobacco stains scrubbed with a solution of washing soda may disappear in this way, but only temporarily. This is due to the solvent driving the staining matter into the surface. In such cases it usually reappears stronger than at first due to the concentration of a larger amount of the stain at the surface. The chief function of a poultice is to draw dissolved staining matter out of the surface. In some cases a porous paper or blotter pasted to the stained surface after the proper solvent has been applied may be made to answer the purpose of a poultice.

When a stain has to be treated with a very volatile solvent, such as benzol, ether, acetone, etc., it has been found best to use a slab of stone or some bricks over the solvent. This prevents a rapid evaporation of such solvents and therefore prolongs their action and also affords a capillary action similar to a poultice. When a slab of stone or bricks are so used, they should be thoroughly dry.

Types of Stains

It may not be possible in some cases of staining to determine the type of stain. Many stains are yellow or brown, resembling iron rust. Oil stains when new resemble the oil itself, but after a considerable period of time they are apt to become yellow or dark brown. Copper and bronze stains are usually green; however, it is quite certain that bronze sometimes causes brown stains. This may be due to the iron or manganese content of the bronze or there is a possibility that it is caused by the alteration of fine particles of pyrites in the concrete. In some of the experiments on copper stains, which were made by a solution of copper sulphate, a brown stain was found on the surface after the copper stain had been removed. This brown stain yielded readily to the treatment for iron stains which indicates that it was caused by the alteration of some element in the surface, since the copper salt applied was "chemically pure."

The term "service stains" may be used to describe a type of discoloration which occurs on interior concrete when it is not properly cleaned. Such discolorations may vary in intensity from a slight yellowing of the surface to very prominent or ugly brown stains. The cause of these is not well understood, and it seems quite likely that there is no single cause for all cases. Some are inclined to attribute such discolorations to "burning" with the polisher or gritting machine. It seems quite evident, however, that some cases of "yellowing" are due mainly to the conditions of exposure and lack of an occasional cleaning. It is practically impossible to find a structural material that will not become badly soiled if it is entirely neglected for a few years. Whatever the cause of service stains or degree of soiling, it is usually possible to bring the surface back to its original appearance.

Concrete in certain parts of buildings is apt to become stained from the perspiration or oil from the hands. Such discolorations sometimes become very prominent and resemble iron stains. This stain is not as difficult to remove as those caused by lubricating oil or linseed oil.

Under damp conditions, wood will rot and finally produce a chocolate-colored stain. When pine wood burns, pitch from the wood may penetrate the surface and produce a stain which is almost black. The eradication of such stains is a slow process, but in many cases it may be entirely practical.

Treatment of Iron Stains

Iron stains can usually be recognized by their resemblance to iron rust or by their position with respect to steel members of the structure.

Method No. 1.—Dissolve 1 part sodium citrate in 6 parts of water. Add to this an equal volume of glycerin and mix thoroughly. Mix a part of this liquid with whiting to form a paste just stiff enough to adhere in a thick coating to the surface. Apply this to the stained area with a putty knife or trowel. This will remain soft for a few days, but when it becomes dry it should be replaced with a new layer or softened by the addition of more of the liquid. While this treatment is entirely free from injurious effects its action may be too slow to be practical in cases of intense stains. Ammonium citrate may be used in the above formula instead of sodium citrate to obtain somewhat quicker results, but, due to the development of an acid condition, it may injure a polished surface to a slight extent.

Method No. 2.—For deep and intense iron it is more satisfactory to employ sodium hydrosulphite ($Na_2S_2O_4$). Before applying the hydrosulphite to the stain the surface should be soaked for a few minutes with a solution of sodium citrate made by dissolving 1 part of the citrate crystals in 6 parts of water. The best way to apply the citrate solution is to dip a white cloth or piece of cotton batting into the solution and paste it over the stain for 10 or 15 minutes.

If the stain is on a horizontal face, sprinkle a thin layer of the hydrosulphite crystals over it, moisten with water, and cover with a stiff paste of whiting and water. If the stain is on a vertical face, place a layer of the whiting paste on a plasterer's trowel, sprinkle on a layer of the hydrosulphite, moisten slightly, and apply it to the stain. Leave this on for one hour and remove. If the stain is not all removed, repeat the operation. Unless the stain is deep, one treatment will remove it. When the stain disappears, rinse the surface thoroughly with clear water and make another application of the citrate solution as at first. This treatment is apt to dim a polish somewhat due to a slight etching effect. However, it is not usually a difficult matter to repolish the treated portion.

Copper or Bronze Stains

Such stains are found where the wash from bronze, copper or brass runs over concrete. The stain is nearly always green, being due to the formation of the carbonate of copper, but bronze work apparently causes a brown stain in some cases. The green stains may be eradicated in the following ways.

Method No. 1.—Mix together in the dry form 1 part of ammonium chloride (sal ammoniac) and 4 parts of powdered talc. Add ammonia water and stir until a paste is obtained. Place this over the stain and leave until dry. When working on polished surfaces, use a wooden paddle to scrape off the poultice, but on a dull finish a trowel may be used. A stain of this kind that has been collecting for several years may require several repetitions of this procedure to completely remove it. Sometimes aluminum chloride is employed in the above procedure instead of sal ammoniac.

Method No. 2.—Dissolve 8 ounces of potassium cyanide in 1 gallon of water. Saturate a thick white cloth in the solution and place it over the copper stain. When the cloth has become dry, soak it again in the cyanide solution and repeat the operation until the stain disappears. Sometimes it may be advantageous to combine this and the method above; that is, remove the greater part of the stain with the poultice and finish with the cyanide solution. This solution is very poisonous if taken into the system.

Tobacco Stains

Method No. 1.—The grit scrubbing powders, commonly used on marble, terrazzo, and tile floors are usually satisfactory for application as a poulticing material on this type of stain. Stir the powder into a pail of hot water until a mortar consistency is obtained. Mix this thoroughly for several minutes, then apply to the stained surface in a layer about one-half inch thick. Leave this on until dry. If working on a polished surface, scrape off the poultice with a wooden paddle; on dull finished surfaces a trowel may be employed. In most cases two or more applications of the poultice will be necessary.

Method No. 2.—If the scrubbing powders called for in method No. 1 are not at hand, the following procedure may be used. Make up a soap solution by dissolving about 1 cu. in. of soap in a quart of hot water. In another vessel make up a solution of sodium carbonate by dissolving one large tablespoonful of soda ash or two tablespoonfuls of washing soda to the pint of water. Combine equal parts of these two solutions and apply a portion of it to the stained surface with a mop, or saturate a piece of cotton batting in the liquid and place it over the stain for a few minutes. Make up a poultice by mixing a portion of the soap and soda solution with powdered talc or whiting. Apply this to the stain and leave until dry. Scrape it off as described above and repeat if necessary. Powdered talc is preferable to whiting, since it holds the moisture longer and thus prolongs the action of the active chemicals. It also has the advantage of being easier to remove from the surface after it has dried. Whiting is apt to cling so firmly that it has to be moistened before it can be scraped off. This is an undesirable feature, since the dried poultice contains the staining matter, and if it has to be soaked loose from the surface some of the staining matter is apt to be driven back into the concrete. If the paste is made of the proper consistency, it can be applied with a paint brush, which makes the process easier in case a large area is to be covered. A whiting paste has the desired brushing properties, but in order to make the talc poultice work well as a brushing coat it is necessary to add a little sugar. About one teaspoonful to each pound of talc will usually give the desired results. Powdered talc in the raw state is of low cost, but is not always easily obtained. When only a small amount is required, one may employ the cheaper grades of talcum powders or purchase the unscented grades from automobile tire distributors.

Method No. 3.—The following formula will be found to be somewhat more efficacious than either of the foregoing: Dissolve 2 pounds of trisodium phosphate crystals in 1 gallon hot water. Mix the contents of a 12-ounce can of chlorinated lime to a paste in a shallow enameled pan by adding water slowly and mashing the lumps. Pour this and the trisodium phosphate solution into a stoneware jar and add water until approximately 2 gallons are obtained. Stir well, cover the jar, and allow the lime to settle. For use add some of the liquid to powdered talc until a thick paste is obtained, and apply as a poultice

¼ in. thick with a trowel. If it is desired to apply this with a brush, add about one teaspoonful of sugar to each pound of powdered talc. When dry scrape off with a wooden paddle if working on polished surfaces, or use a trowel if on dull finishes. This mixture is a strong bleaching agent and is corrosive to metals, hence in using it care should be taken not to drop it on colored fabrics or metal fixtures.

This formula is also valuable for treating other stains and will be frequently referred to in the following methods. Trisodium phosphate may be purchased at most drug stores, at chemical supply houses or laundry supply houses.

Urine Stains

Use method No. 3 as outlined above for tobacco stains. Some parts of the stain may prove stubborn in which case saturate a layer of cotton batting in the liquids and paste over that part of the surface. Resaturate the cotton if necessary.

Where polished concrete has long been exposed to the action of urine, the polish will usually be injured. To restore the polish, moisten a piece of felt cloth or chamois skin with water, dip it into some FF carborundum or emery flour and rub the surface until it appears perfectly smooth and somewhat glossy. Then use some putty powder in the same way until the desired polish is obtained. When applying the putty powder, use a new piece of felt or chamois skin.

Fire Stains

Often in the case of fires, concrete is not appreciably injured but may be badly discolored from the smoke or pitch from burning wood. Sometimes it is entirely feasible to restore the original appearance by the following process: First scour the surface with powdered pumice or a grit scrubbing powder to remove the surface deposit, then make up a solution of trisodium phosphate and chlorinated lime as described in method No. 3 for tobacco stains. Fold a white Canton flannel cloth to form three or four layers and saturate it in the liquid. Paste this over the stain and cover it with a piece of pane glass or a scrap slab of concrete, making sure the cloth is pressed firmly against the surface. Resaturate the cloth as often as necessary. Deep pitch stains are difficult to remove, and hence several treatments will be necessary. To restore the polish, use the method described above under method of treating urine stains.

Lubricating Oil Stains

Lubricating oil penetrates quite readily, and if accidentally dropped on the surface of concrete it should be mopped off with a cloth and covered with fuller's earth or other dry powdered material, such as hydrated lime or whiting. In some cases a layer of dry portland cement will serve the purpose. The oil that has penetrated may usually be removed in this way if treated soon after the stain occurs. However, when the oil has remained on the surface for a considerable period of time and thoroughly oxidized it will prove very difficult to remove. Such stains can usually be removed as follows:

Method No. 1. Cut a piece of white Canton flannel somewhat larger than the stain and saturate it in a mixture of equal parts of acetone and amyl acetate. Place this over the stain and cover with a piece of pane glass, or preferably a small slab of concrete. If the stain is in the wall, it will be necessary to improvise a means of supporting the cloth and its covering in place. Usually it will not be a difficult matter to arrange a prop of some kind to answer the purpose. When the cloth becomes dry, it should be again saturated and covered as at first. Old oil stains are difficult to remove and their treatment may require a great deal of patience. The solvent may spread the stain somewhat, in which case a larger cloth should be used. In covering the saturated cloth with a piece of glass the stain is driven into the concrete, while if a dry slab of concrete is used instead of the glass, some of the oil will be drawn into it.

Method No. 2. A method frequently used consists in mixing a solvent, such as benzol or gasoline, with a dry powder to form a paste which is plastered over the stain. Hydrated lime, marble dust, whiting or similar material may be used for this purpose. While this method is said to be satisfactory for such oil stains as occur in construction, it acts slowly on old oil stains which have dried and oxidized.

Method No. 3. Lubricating oil stains can be removed with more facility where the following method can be used. Place a layer of asbestos fiber about ¼-in. thick over the stained portion, saturate it with amyl acetate, and cover with a scrap slab of concrete. Place on top of the auxiliary slab a hot iron of about the temperature used for pressing fabrics. Apply more of the amyl acetate as the asbestos becomes dry and reheat the iron as often as necessary. A few layers of Canton flannel may be used instead of asbestos fiber if care is taken not to scorch the cloth. Stains from scorched cloth may be removed by the same method recommended for fire stains.

Linseed Oil Stains

This type of stain is usually found around plumbing fixtures where putty has been used. The linseed oil from the putty may spread for some distance through the concrete and produce a stain that is very difficult to remove. The oil in oxidizing forms a "resinous matter" which practically seals the pores and effectively prevents the penetration of any solvent which may be applied. Although putty has been frequently used for filling around pipes where they pass through concrete, its use for this purpose is objectionable because of the stains that are apt to occur. Grafting wax has been found to be a more desirable material for the purpose, due to the fact that it does not stain the concrete and can be easily removed in case the piping has to be changed.

Experiments have been made on several treatments applied to the inside walls of openings through concrete to prevent the penetration of linseed oil from putty. The only application of this kind that was found effective consisted of sodium silicate. At least two applications of the sodium silicate should be made, the first consisting of the commercial silicate diluted with twice its volume of water, and the second consisting of the undiluted silicate. This should be applied with a brush, and ample time should be allowed for each application to dry.

Method No. 1 recommended for use on lubricating oil stains will slowly dissolve this "resinous matter" and reduce the stain, but it is not well adapted to use around plumbing fixtures. It is sometimes satisfactory to bleach the coloring matter in such stains as follows:

Method No. 1. Cut a piece of thick white cloth or a layer of cotton batting to fit around the fixture. Saturate this with hydrogen peroxide and paste it over the stain. The bleaching action may be accelerated by moistening another cloth in ammonia water and placing this over the first. Repeat the operation as described until the discoloration is removed.

Method No. 2. Mix together in the dry state the following: One part trisodium phosphate, 1 part sodium perborate, and 3 parts powdered talc. Make a strong soap solution in hot water and add enough of this to the dry mixture to form a thick paste. Cover the stain with the paste and leave until dry. The same material can be used over again by reducing it to a paste with some more of the soap solution. In some cases it may be found desirable to alternate this treatment with method No. 1 for lubricating oil stains.

Method No. 3. Combine equal parts of wood alcohol and a 10 per cent solution of trisodium phosphate. Make a paste of this mixture and asbestos fiber sufficient to cover the stain with a layer ¼-in. thick. Place a scrap slab of concrete over this and apply a hot iron as described in method No. 3 for lubricating oil stains. A few repetitions of this process may be necessary in cases of very pronounced stains.

Perspiration Stains

Secretions from the hands or oil from the hair may produce stains on concrete. The stain is brown or yellow and may be mistaken for an iron stain. The best treatment found is that recommended for fire stains. Bad stains of this kind are rather stubborn and may require several treatments.

When the entire terrazzo work of a building takes on a dingy or somewhat yellowish appearance it is quite likely to be due to improper or insufficient cleaning. If certain areas become yellow while adjacent slabs remain free from discoloration, the trouble was probably caused in the original finishing of the floor. Such discolorations are not usually hard to remove by poultice methods, or they may yield to a surface scrubbing with Javelle water. Javelle water can usually be purchased at drug stores or may be prepared as follows:

Dissolve 3 lbs. of washing soda in 1 gallon of water. Mix the contents of a 12-ounce can of chlorinated lime to a paste in a shallow enameled pan by adding water slowly and mashing the lumps with a spatula or pointing trowel. Add the paste to the soda solution, make up to 2 gallons by adding water, and place in a covered stoneware jar to settle. Pour off the clear liquid when required for use and dilute with six times its volume of clear water. Use this to wash the concrete the same as a soap or other scrubbing solution is used. In using this solution it is advisable to first rinse the surface with clear water before scrubbing with Javelle water. This is a strong bleaching material, hence it should not be allowed to drip on colored fabrics. This is not recommended for general cleaning purposes, but its occasional use on stained concrete is believed to be entirely safe.

Poulticing with commercial grit scrubbing powders, such as those commonly used for cleaning marble floors, will prove satisfactory for removing most stains of this class. In poulticing with these the material is slowly stirred into a pail of hot water until a thick paste of mortar consistency is obtained. A small addition of whiting will add somewhat to the working qualities of the poultice. This is applied to the surface with a trowel in a layer ¼-in. thick or more and allowed to remain until dry, when it is scraped off with a wooden paddle.

Since such discolorations are apt to cover a considerable area, it will be found more expedient to use a poultice that may be applied with a brush instead of a trowel. Method No. 3 for tobacco stains is well adapted to this purpose.

Los Angeles Leads in 1928 Pavement Construction

The city of Los Angeles, California, during 1928, led other communities in concrete pavement construction by laying approximately 160 miles. Seattle, Chicago, and St. Louis followed in the order named.

New Books

INVESTIGATIONS ON BREEZE AND CLINKER AGGREGATES. Technical paper No. 7 on building research published by the Department of Scientific and Industrial Research of the British government.

This paper describes a rather complete investigation of the properties of cinder when used as aggregate in concrete. It is probably as complete and authoritative as anything available on the subject.

How to Test Cinder Concrete

In an appendix there are described two methods of testing cinders to determine their suitability for use as an aggregate. One of these tests is about as close as possible to what practical concrete products manufacturers require. We are accordingly quoting it here at some length for the benefit of those readers who are interested in cinder concrete.

"The material to be tested is sampled and ground until a sample of about ½ to 1 lb. is obtained.

"This is ground to pass a sieve containing 76 meshes to the inch and the material so obtained is used for the . . . test.

"This test is based on the expansion which occurs during the first few days of setting of a concrete containing class C or B coals. The expansion, though easily measured in the laboratory, does not, except in extreme cases, cause the formation of visible cracks in a concrete by which its occurrence could be detected. In conjunction with the further maturing movements associated with the absorption of oxygen by the coal, it does, however, lead to ultimate cracking after a period which may extend to many months. Even in cases where ultimate visible cracking never occurs the movements may be so large as to be a source of danger to the structure.

"In the test described below a mixture of plaster of Paris and a normal portland cement is used. This, mixed with the breeze to be tested, sets rapidly, and any expansion taking place does so in this set material and causes visible cracks. The form of the test specimen (the pat) used is such as to render it sensitive to small expansions.

"The following are required.

"(1) A normal portland cement conforming to the British Engineering Standards specification.

"(2) Fine white plaster of Paris (it is most important that no other type of plaster should be used).

"(3) Some pieces of glass sheet about 4 by 4 in. in size. These must be clean and not greasy.

"The following mix is prepared:—

"One part by weight of above cement.

"One part by weight of above plaster.

"These must be thoroughly well mixed and stored in a dry place in a tin with closely fitting lid. Fresh mixes should be made up every few weeks and older mixes rejected.

"One part by volume of this plaster mix is mixed with three parts of the breeze sample ground to pass a 76-mesh sieve as described above. The whole must be thoroughly well mixed while dry and any small lumps carefully broken down. It is gauged with water to a plastic condition, and then worked into a rough ball about 1½ in. in diameter and placed on the center of a glass plate. The mix must be of such plasticity that it flows outwards towards the edge of the plate when the latter is tapped. The plate is tapped until the lump has formed a pat about 3 in. in diameter, which is finally shaped by stroking with a knife from the outside edge towards the center. The completed pat should be about ½ in. deep at the center and taper away to a thin edge at the circumference.

"If the mix is made too wet the pat will tend to flatten out excessively. This must be avoided and the pat dimensions kept as nearly as possible to the dimensions given. The gauging and making of the pat should be completed within five minutes of the time of addition of the water to the mix or the initial set of the plaster may be destroyed. The pat will set hard within about fifteen minutes.

"About 1½ oz. altogether of breeze and plaster-cement mix are required for each pat. Two pats should be made, starting with a fresh dry mix for the second pat.

"As soon as the pats are made they must be placed in a moist atmosphere, e. g., in a vessel containing water, but raised above the water surface and kept there for 3 to 4 hours. This time must not be exceeded. The pat is then totally immersed in water and left there. Care must be taken only to handle the pats by the glass at the edge and not to touch the pat itself. They must further not be subject to vibration.

"The pats are examined after one to four days in water. Within this period fine radial cracks may appear running from the edge to the center, or the edges of the pat may lift in a marked manner away from the plate, or the pat may become loose on the plate. If any of these symptoms appear within four days' immersion in water, the breeze (cinders) is unsound and should be rejected.

"If no such signs appear in four days the breeze may be used. With thoroughly sound materials the pats are unchanged after 3 to 4 weeks, but with some breezes slight lifting of the edges after 7 to 10 days may occur, followed in some cases by eventual cracking. For most purposes such materials may be used, and only those failing, as defined above, within four days rejected.

"In certain cases where a concrete is subject to definite end restrictions on its movements, for instance, in a floor in a building it is important that any material showing even a relatively small setting movement should be rejected, or bulging of the walls may result. For such cases a more severe test than the above should be applied. The test is carried out just as the above, but only one part by volume of the plaster-cement mix to five parts of breeze is used. The pat is treated just as before and kept in water for seven days. At the end of this period the pat should remain firmly attached to the glass plate, and show no sign of the edges lifting away from the plate. Many breezes will fail under this more rigid test, but good clinkers will usually pass it."

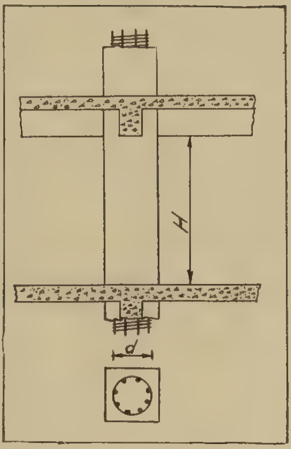
Reinforced Concrete Design Simplified

Chart M—Spiral Reinforced Column

By PROF. JAMES R. GRIFFITH
Armour Institute of Technology; Assoc. M., A. S. C. E.

Joint Committee Specifications

$f'_c = 2{,}000$ lbs. per sq. in.
$f_c = 300 + (0.10 + 4\,p)\,f'_c$
$n = 15$
$P = A_c f_c + n f_c p A$
h/R to be less than 40
Spiral steel $= A_s/4$



THE total load permitted on spiral reinforced columns by the Joint Committee, as will be seen from Chart M, is a function of the core diameter and the area of the longitudinal steel. This represents conservative design and does not consider, as many codes do, the spiral steel as additional reinforcing.

Application of Chart M

Let me take the following conditions to demonstrate the application of this chart.

Given: Total column load = 400,000 lbs.
Column dimensions:
Over all 24 by 24 in.
Core diameter = 20 in.
Height of column, floor to beam bottom = 12 ft.

Required to design the longitudinal and spiral steel.

The least radius of gyration of the column core is

$$R = \frac{d}{4} = \frac{20}{12 \times 4} = 0.417 \text{ ft.}$$

The ratio of the unsupported height to the least radius of gyration is

$$\frac{h}{R} = \frac{12}{0.417} = 28.8$$

This value is within the limits permitted so Chart M is applicable.

On Chart M isopleth (1) has been drawn through the core diameter of 20 in., the total column load of 400,000 lbs., and gives a ratio of

$$p = 0.0396.$$

Isopleth (2) on the smaller nomograph is drawn through the core diameter and the ratio (p) just found, giving on the central scale an area of longitudinal steel of

$$A_s = 12.2 \text{ sq. in.}$$

$$\text{Percentage of spiral steel} = \frac{3.96}{4} = 0.99$$

$$\text{Area of spiral steel} = \frac{12.2}{4} = 3.05 \text{ sq. in.}$$

From Chart C:

Given $A_s = 12.2$ sq. in.
Use ten 1⅛-in. square bars
Actual $A_s = 12.6$ sq. in.
Actual (p) $= 0.402$ (from Chart M)

Spiral steel is given two ways. Some authorities give it in the terms of equivalent area, while others give it in terms of a percentage. A 20-in. diameter spiral of ⅜-in. round wire at a 2¼-in. pitch meets our requirements giving

Percentage = 1.0
Equivalent area = 3.47 sq. in.

Check Solution

Previously determined:

$A_s = 12.6$ sq. in.
$p = 0.0402$
$A = 314$ sq. in. (Diam. = 20 in.)
$A_c = A - A_s = 301.4$ sq. in.

From specifications:

$f_c = 300 + (0.10 + 4p)\,f'_c = 818$ lbs. per sq. in.

Total column load:

$$\begin{aligned} P &= A_c f_c + n f_c p A \\ &= (301.4 \times 818) + (15 \times 818 \times 0.0402 \times 314) \\ &= 401{,}500 \text{ lbs.} \end{aligned}$$

Joint Committee Specifications

The following sections on reinforced concrete columns are based on the assumption of a short column.

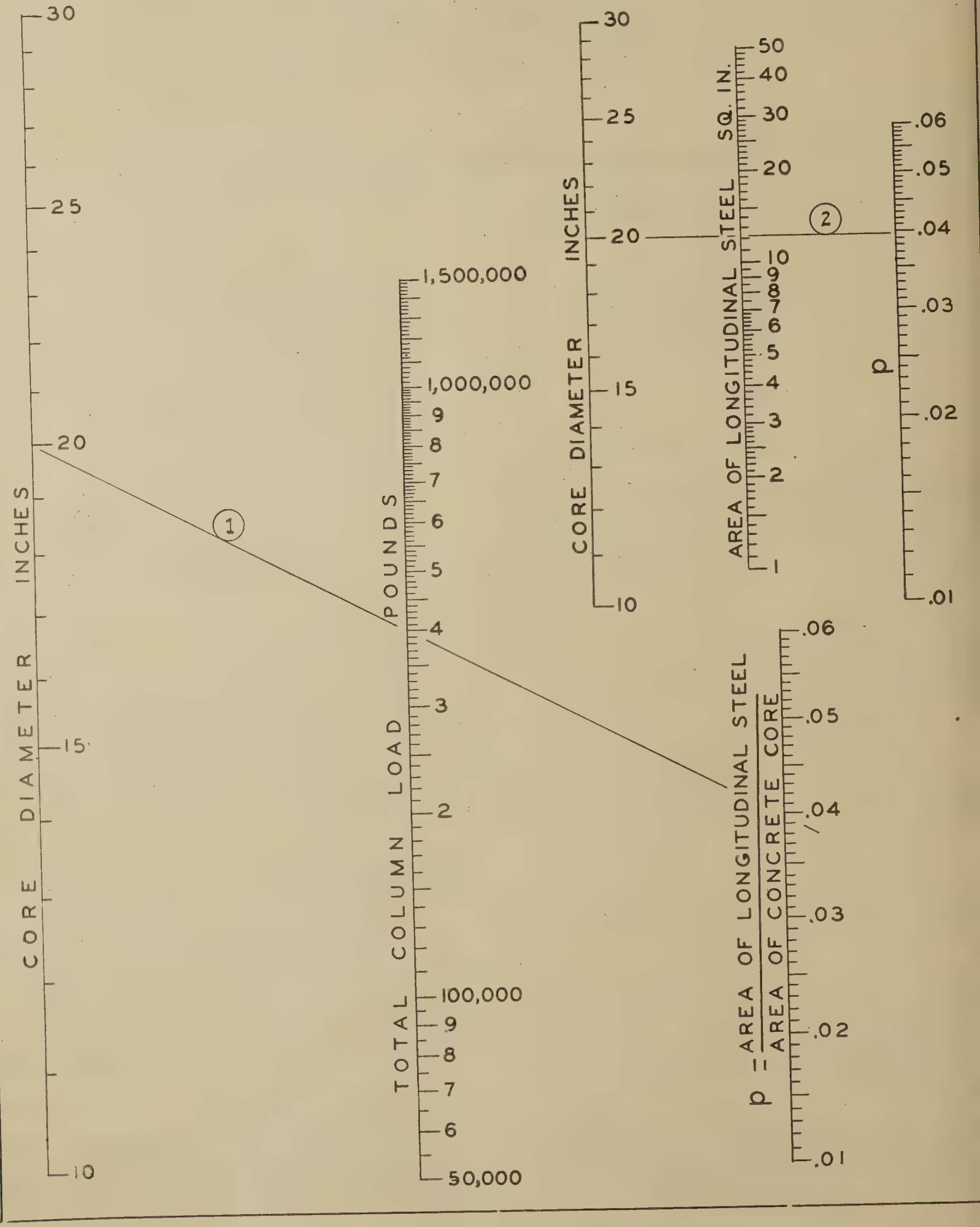
The unsupported length of reinforced concrete columns shall be taken as:

CHART M

Spiral Reinforced Column

$f_c = 2{,}000$ lbs. per sq. in.
h/R = Less than 40

$$\text{Spiral Steel} = \frac{\text{Longitudinal steel}}{4}$$



(a) In flat slab construction the clear distance between the floor and under side of the capital;

(b) In beam-and-slab construction, the clear distance between the floor and the under side of the shallowest beam framing into the column at the next higher floor level;

(c) In floor construction with beams in one direction only, the clear distance between floor slabs.

When haunches are used at the junction of beams or struts with columns, the clear distance between supports may be considered as reduced by two-thirds the depth of the haunch.

The safe axial load on columns reinforced with longitudinal bars and closely spaced spirals enclosing a circular core shall be not greater than that determined by the formula:

$$P = A_c f_c + n f_c p A \qquad \text{Eq. 1-M}$$

P = total safe axial load on columns whose h/R is less than 40;

A = area of the concrete core enclosed within the spiral; the diameter of the core shall be taken as the distance center to center of the spiral wire;

p = ratio of effective area of longitudinal reinforcement to area of concrete core;

$A_c = A(1 - p)$ = net area of concrete core;

f_c = permissible compressive stress in concrete = $300 + (0.10 + 4p) f_c$. Eq. 2-M

The longitudinal shall consist of at least six bars of minimum diameter of ½ in., and its effective cross-sectional area shall not be less than 1 per cent nor more than 6 per cent of that of the core.

The spiral reinforcement shall be not less than one-fourth the volume of the longitudinal reinforcement.

Reinforcement shall be protected everywhere by a covering of concrete cast monolithic with the core, which shall have a minimum thickness of 1½ in. in square columns and 2 in. in round or octagonal columns.

Chart Construction

Eq. 1-M, as stated in the specifications, is the formula for the permissible load on a short column. The portion of the expression $(A_c f_c)$ giving the load carried by the concrete, while the expression $(n f_c p A)$ gives the load carried by the longitudinal steel.

For the limits herein considered, the allowable stress in the concrete as given by Eq. 2-M reduces to the form

$$\begin{aligned} f_c &= 300 + (0.10 + 4p) f'_c && \text{Eq. 2-M} \\ &= 300 + (0.10 + 4p)\ 2000 \\ &= 500 + 8000\,p && (1) \end{aligned}$$

Substituting expression (1) in Eq. 1-M

$$\begin{aligned} P &= A_c f_c + n f_c p A && \text{Eq. 1-M} \\ &= f_c (A_c + npA) \\ &= (500 + 8000\,p)\,(A_c + 15pA). \end{aligned}$$

But the area of the concrete core can be written

$$A_c = A\,(1 - p)$$

So I can simplify the expression still further to

$$P = (500 + 8000\,p)\ [A(1 - p) + 15pA]$$

When this last expression is multiplied out and factored, it reduces to the form

$$\begin{aligned} P &= A\,(335p + 22.4)^2 \\ &= \frac{3.1416\,d^2}{4}\,(335p + 22.4)^2 \end{aligned}$$

This is still in a form rather difficult for nomographic construction. However, if I let

$$y = 335p + 22.4$$

the expression can then be written

$$P = \frac{3.1416\,d^2\,y^2}{4} \qquad (2)$$

which is in a form suitable for comparing to the general equations. Expression (2) corresponds to general Equation 7 requiring logarithmic co-ordinates for nomograph construction.

$$C = L^{mn/r}\,.\,R^{m(1-n)} \qquad \text{Eq. 7}$$

I have used the (d-20) scale for the co-ordinates of the two outside scales making

$$r = 1$$

Equating the general exponents of Eq. 7 to the actual exponents of expression 2 and substituting the value $(r = 1)$, I have

$$\left.\begin{aligned} mn/1 = mn &= 2 \\ m(1 - n) &= 2 \end{aligned}\right\}$$

which when solved simultaneously give the values

$$\left.\begin{aligned} n &= \tfrac{1}{2} \\ m &= 4 \end{aligned}\right\}$$

Thus the central scale must be half way between the two outside scales and have co-ordinates ¼ the size of those used on the outside scales. This will necessitate the use of the A-10 scale for values of (P). I am not interested in values of (y), so I have prepared a table showing the relation of (y) to (p). Table 1-M shows every fifth value although actually every graduation plotted on the (p) scale was figured.

TABLE 1-M

p	$y = 335p + 22.4$
.01	25.75
.015	27.43
.02	29.11
.025	30.74
.03	32.45
.035	34.12
.04	35.80
.045	37.46
.05	39.15
.055	40.81
.06	42.50

On the right scale (R) I have plotted these values of (y) and labeled them their corresponding value of (p).

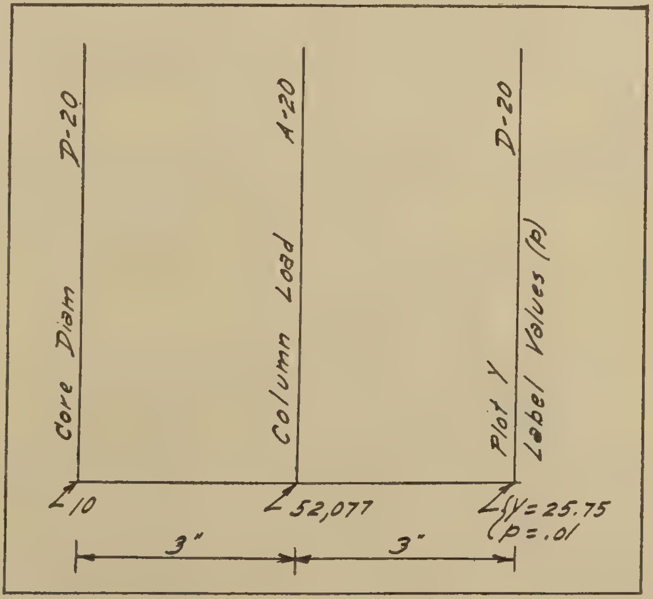


Figure 1-M

Fig. 1-M shows the complete details for plotting the large nomograph of Chart M.

Since (p) gives the ratio of the steel to the core area, we have

$$A_s = A\,p = \frac{3.1416}{4}\,d^2\,p \qquad \text{Eq. 3-M}$$

So a smaller nomograph was added to provide a quick means for determining the area of the longitudinal steel.

Eq. 3 corresponds to the general expression requiring logarithmic co-ordinates for nomographic construction.

$$C = L^{mn/r}\,.\,R^{m(1-n)} \qquad \text{Eq. 7}$$

I used the A-10 scale for values of (p) on the right (R) scale, and the D-10 scale for values of the core diameter on the left (L) scale. This made the ratio

$$r = \tfrac{1}{2}$$

Equating the actual exponents of Eq. 3-M to the general exponents of Eq. 7 and substituting the value of (r),

$$\left.\begin{aligned} mn/r &= 2mn = 2 \\ m(1-n) &= 1 \end{aligned}\right\}$$

Solving these two expressions simultaneously for values of (m) and (n) I have

$$\left.\begin{aligned} m &= 2 \\ n &= \tfrac{1}{2} \end{aligned}\right\}$$

Thus the central scale must come half way between the two outside scales and have co-ordinates one-half the size of those used on the right (R) scale. This will necessitate the use of the A-10 scale for values of A_s. Figure 2-M shows the complete details by which the original nomograph was constructed.

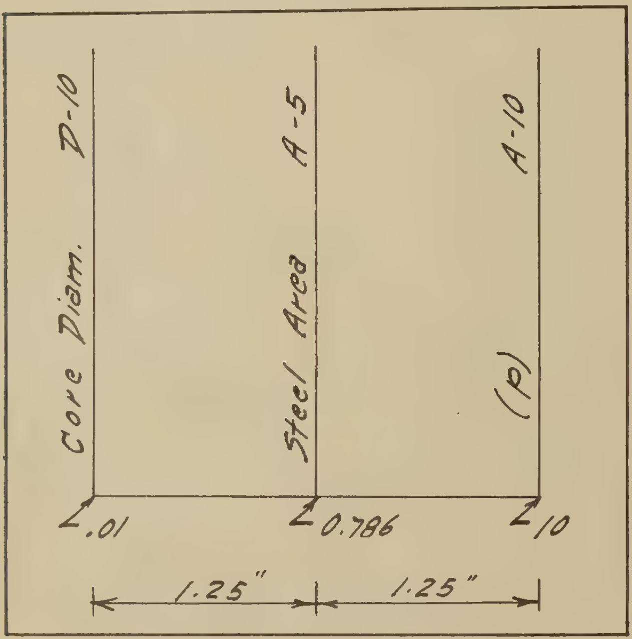


Figure 2-M

Tennessee Highway Department Investigates Curing Methods

One of the most important functions in the construction of a portland cement concrete pavement is its curing.

Many different methods for obtaining proper curing have been devised by state highway departments and manufacturers of curing products, but no concerted research has ever been instituted to determine which of these is the best method.

The Tennessee Highway Department following its usual policy of determining the best methods of construction, has started to investigate, in co-operation with the Bureau of Public Roads, twenty different methods of curing. These methods are to be applied to a regular construction project so that the additional cost will be minimized and so that the results will be entirely applicable to field conditions. This research project, known as the "Oakland Curing Project" is located in Fayette County on Route 15 east of Memphis. B. W. Higley, resident engineer, is in direct supervision of this work for the state and S. F. Turner represents the Bureau of Public Roads.

Seventeen miles of this pavement are to be cured on one side by the standard method of earth curing specified in the contract with the J. B. McCrary Engineering Corporation of Atlanta, Georgia; and the other side is to be cured by the highway department so that there will be one section each of the twenty different curing methods. Each section is to be approximately one thousand feet long. Each series of twenty methods will be repeated four times throughout the season so that conditions of temperature and moisture will be averaged.

This Oakland research project represents the most comprehensive effort to determine the proper curing methods in the United States. The Bureau of Public Roads, the National Research Council, and the American Society for Testing Materials have indicated their intense interest, and wish to co-operate to the fullest extent. Without question the results obtained will definitely decide for Tennessee the best methods of performing this most important function and will give to the field of highway engineering some of the most important data evolved in recent years.

Block Standard Raised to Meet Association Tests

A short item which appeared on page 42 of the March issue of CONCRETE described briefly the activity of the Bergen County Concrete Products Association in insuring a quality product by periodic testing.

More detailed information has now been made available by Horace W. Bush, president, who states that three years ago the concrete block situation in the county was in a deplorable condition, attributed to the fact that there was practically no inspection of products on jobs.

Realizing the necessity of raising the standard of quality of concrete block, three or four of the larger plants began the organization of what is now known as the Bergen County Concrete Products Association. Improvement began at once and in six months the quality of block among the members of the association was raised 25 per cent. The test standard was placed at a compressive strength of 750 lbs. per sq. in.

Selections of block are now made four times a year from the job by a representative of the Portland Cement Association and of the testing laboratory employed. No advance notice of when the tests are to be made is given members, to insure true representatives of products. Specimens for the three compression tests to be made are first capped to a true plane with plaster of paris and tested in a standard Olsen compression machine. The test used is that of the American Society for Testing Materials. Specimens for the two absorption tests are first dried to a constant weight and immersed in water for 24 hours. After this interval they are removed, re-weighed and the absorption calculated. The absorption is noted in pounds of water absorbed per cubic foot of masonry, in accordance with American Concrete Institute recommendations.

If the tests show that a member's product does not meet the standard, a re-check is made within 28 days. If the second test does not meet the standard, the member is suspended and the building department of each of the 62 municipalities in the county is informed of the fact.

Painless Bookkeeping For Products Plants

The Eighth and Last Article of a Series Presenting a Simplified Method of Keeping Products Plant Records—Methods of Arriving at Itemized Costs Per Block Are Discussed in This Issue

By F. W. SCHNOEBELEN

Part VIII.—Cost Accounting

In the article published last month, we closed the books of the Standard Block Corporation after this hypothetical organization had been operating for one month. Throughout the series we have seen how this concern opened a set of books, started operations, and kept its records.

Last month we saw that, after a month's operation, the Standard Block Corporation was in a much better condition from a business point of view than when it started. We saw that a net profit of $1,480 was the reward for the month's business.

But we do not yet know just what the cost of materials, labor, manufacturing expense, selling expense and administrative expense per block was. It is necessary that we know this, so that we will be able to fix a fair sales price on which a reasonable profit can be assured. In this, the last article of this series, this very important subject of cost accounting is explained.

THERE are many methods of ascertaining the cost of concrete products. Cost accountants who have worked on this subject, as a rule, use methods too complex for the average concrete products manufacturer to understand or to put to practical use. We do not question the accuracy of their methods, but we do question their procedure. The concrete products business today is in the stage of development, and the average manufacturer can hardly afford to hire a cost accountant to determine his costs. He must find a practical method, so simple in form that the average manufacturer may determine his own cost within a minimum amount of time.

We have made a study of numerous methods, not only from the point of view of accuracy, but also from the point of view of simplicity. As a result, we can safely say that the practice of changing all the products manufactured into their equivalent of the standard unit and then determining the cost from the usual amount as revealed by the books is the most practical.

How Units Are Changed to a Standard Basis

To change all units manufactured into their equivalent of the standard unit may be done by either of two methods—weight or price. Either method is good. In this particular instance we will use the selling price of the units at the beginning of the year. To determine the equivalent on a price basis, we use the same method that was used in determining our production and sales in the terms of a common unit as was shown in Part I and II of this series. That method was to take the selling price of each particular unit, multiply it by the number manufactured and then divide the resulting product by the selling price of the standard unit (8 by 8 by 16 plain). This gives us the number of units of 8 by 8 by 16 plain on a price basis. The method for tabulating the production was fully explained in Part I, and by referring back to the article, you will be able to refresh your memory on the method used to change all units into terms of one common unit.

We are now ready to determine the cost of the 8 by 8 by 16 plain block and have changed all other units manufactured over into that term. Exhibit I is an example of the cost sheet. As mentioned before, in order to determine the cost by this method we must have a record of the production and the sales. These items are, then, the first to be placed on the cost sheet.

EXHIBIT I.

The Standard Block Corporation of America

THE COST SHEET

January 31, 1929

Production for Month of January				37,403 units
Sales for the Month of January				30,943 units
Cost per unit (8 by 8 by 16 plain).				
Manufacturing Cost				
Raw Materials:				
Cement	($1385.00)	$0.0370		
Gravel and Stone	($1005.00)	$0.0269		
Miscellaneous Material	($ 120.00)	$0.0032		
Total		$0.0671		
Less Discounts on Materials	($ 125.00)	$0.0033	$0.0638	
Direct Labor	($ 900.00)		$0.0241	
Manufacturing Expense	($ 520.00)		$0.0139	
Total				$0.1018
Yard Cost				
Selling Cost	($ 280.00)		$0.0075	
Administrative and Financial	($ 740.00)		$0.0198	$0.0273
Total				$0.1291
Delivered Cost				
Delivery Expense	($ 600.00)			$0.0194
Total				$0.1485

First, let us determine the manufacturing cost. This comprises the cost of the raw materials, direct labor and the manufacturing expense or overhead. The raw materials include all the materials that were used in manufacturing the unit, such as cement, sand and stone, and miscellaneous material such as calcium chloride or any other admixture. To determine the amount used during the month, we take the amount on hand at the beginning of the month, plus what was purchased, less the amount that we have on hand at the end of the month. This gives us the amount actually used in producing the number of blocks for the month.

Amount of Raw Materials Consumed in January 1929

	Cement	Gravel and Stone	Miscellaneous Material
On hand January 1, 1929	$ 250.00	$ 125.00	$ 25.00
Purchased, January 1929	$1260.00	$ 940.00	$110.00
Total	$1510.00	$1065.00	$135.00
Less-inventory January 31, 1929	$ 125.00	$ 60.00	$ 15.00
Net amount used January 1929	$1385.00	$1005.00	$120.00

The amount of the inventories is taken from the inventory book and the amount of the purchases from their respective accounts in the general ledger. After these amounts have been determined, we take the cost of each material and divide into it the number of units manufactured for the month. This will give us the cost per unit. For instance, $1385.00 (the cost of cement) divided by 37,403 units, gives us $0.0370, the cost of the cement for an 8 by 8 by 16 plain block. After we have determined the cost of all the materials, we take the amount of the discount earned on the raw materials and determine the amount of discount per block. This amount, subtracted from the total cost of the raw materials, gives us the net cost of the materials as shown on Exhibit I. In like manner we take the total amount of the direct labor from the ledger and determine the cost of the direct labor per block. The manufacturing expense comprises the indirect labor, machinery maintenance and depreciation, building depreciation, taxes, insurance and miscellaneous manufacturing expense. If we have a great deal of time at our disposal, we may determine the cost per unit for each item or we may group them as was done in Exhibit I, which shows the total cost of this item to be $520.00 or $0.139 per unit. By adding the cost of the raw materials, direct labor and manufacturing expense, we find that the total manufacturing cost is $0.1018 per 8 by 8 by 16 plain unit.

Selling and Administrative Expense

When the block is placed in the yard we have other costs that must be added to the manufacturing cost, such as the selling expense and administrative and financial expenses. The selling expense includes the cost of the salesman, advertising and all the other miscellaneous costs of selling. The amount of selling expense is taken from that account in the general ledger. We then determine the cost per unit, as was done with the other items. Administrative and financial expense include the salaries of the executives and clerks, interest, office supplies or any other miscellaneous expense incurred in running the business. The total of this amount we also take from its respective accounts in the general ledger. The selling and administrative and financial expense added to the manufacturing expense brings the cost per unit up to $0.1291. This amount per unit is then what it cost us to put an 8 by 8 by 16 plain block in the stockpile for the month of January.

To determine our delivery cost, we take the total amount of our delivery expense, which is also a general ledger account, and comprises all the costs for placing the product on the job and divide this amount by the number of units sold, instead of the number of units manufactured as was done with the other items. This gives us the delivery cost per unit. For instance the delivery expense as shown by the general ledger was $600.00 divided by 30,943 (the number of units sold in January) gives us $0.0194 per unit as the delivery expense. This, in turn, added to the yard cost, brings our total cost per unit for 8 by 8 by 16 plain to $0.1485.

Odd Size Units

After determining the cost of the standard unit, or our biggest seller, it is comparatively easy to determine the cost of the various odd size units on a percentage basis. For instance, the 8 by 8 by 16 block contains approximately one-fifth more material than the standard unit (8 by 8 by 16). We merely add one-fifth of the cost of the standard unit to its cost price which gives us approximately the cost of the 10-in. block. For instance, the 8 by 8 by 16 plain cost is $0.1485 per unit. Then, adding one-fifth of $0.1485 or $0.0297 to $0.1485 equals $0.1782, or the cost of the 8 by 10 by 16 plain. In like manner we may determine the cost of each particular unit on a percentage basis. You can readily see that by using the percentage method, the various incidental expenses as well as the material are added into the cost of the unit in proportion to the amount of the material used. For instance, if the delivery expense for the 8 by 8 by 16 block was $0.02 per unit, then the delivery expense for 8 by 10 by 16 block would be one-fifth more or $0.0240 per unit. This is fair because the 8 by 10 by 16 block is larger and weighs more; naturally the cartage would be greater on this unit. I think further explanation of the percentage basis for determinining the cost of the unit is unnecessary, if we carefully study this method.

The cost of the standard unit will vary from month to month due to the fluctuations in the cost of the material, labor and overhead. It is advisable then to determine our costs monthly and take the average over a period of months to determine our true costs.

After we have determined our costs, we are ready to determine our selling price. The margin on each unit the manufacturer is entitled to depends on the manufacturer and the business conditions in general. During business depressions, or in a very competitive market we must sometimes take a very small margin or sell at cost to get our overhead down and to keep the factory working. On the other hand, we may be able to receive as much as a $0.05 margin per unit when business conditions are good. Whatever conditions may be, the manufacturer should strive to keep the market stable and not fluctuate prices from day to day, if he wishes to build up a successful business. The manufacturer should figure his cost every month as part of the business and should never neglect to do so under any circumstances. He should also keep and file all cost sheets for future reference.

With this article the writer closes the series on simplified bookkeeping and cost finding for concrete products manufacturers. No doubt to some of you much that has been presented seemed elementary or you may have felt indifferent toward it due to better methods that you may have. But these articles were written for the concrete products manufacturers as a whole throughout the country to awaken to the need of better business methods. If the average manufacturer has thoroughly studied these articles, then the writer feels that their purpose has been accomplished.

Concrete for the Builder

A NEW DEPARTMENT

WITH this issue we introduce a new department which, we believe, meets a definite need and which is not duplicated in any other publication.

In this department we are going to present material selected particularly for the concrete builder—the contractor who specializes in the construction of foundations for apartment houses, stores and residences, driveways, concrete floors, swimming and wading pools, porches, park structures, and a hundred and one other structures of a similar nature.

This contractor has problems of his own, separate and distinct from those of the contractor who specializes in skyscrapers, dams, breakwaters and other engineering structures. The principles of making good concrete are, of course, the same for all types of structures, and because of that, the concrete builder will find much of interest and value to him in the other pages of each issue also. Similarly, the engineering-structures contractor will find much of value to him in the pages of this new department.

The concrete builder is concerned primarily with the smaller types of concrete structures. Each job is not large, so, in order to increase his business, he must secure more jobs.

There is scarcely a home owner in any community in the United States that could not be sold some concrete structure if a salesman would call on him. The idea of selling the building contractor's service may seem new to some builders at first glance. But it is a very logical thing to do.

The concrete products industry is a good example of the value of merchandising. In 1919 the concrete block man was not of a great deal of importance in his community. Then he started to realize that ***merchandising*** would put his business on the map. Salesmen were trained and hired to go out and get business. In less than ten years, block sales increased from less than 100,000,000 units per year to more than 384,000,000. Selling did it!

The concrete builder has a much larger field to work in than the concrete block man has. He needs salesmen to expand his business as much as the products manufacturer did. By going out after business, the aggressive concrete builder can increase his volume of work many times. In this age of keen selling competition an industry that does not sell goes backward instead of forward.

This new department is designed for the purpose of helping the concrete builder increase his business. In these pages articles will be published each month telling the builder how to sell his services; suggestions for new work will be made and explained; detailed instructions on how to build these structures will be presented in plain, helpful language, and the experiences of builders who are already going after business aggressively will be published. In short, the articles will tell you what to sell, how to sell it, and how to build it in the best and most economical manner.

An editorial program covering the entire range of subjects relating to any work that the concrete builder may undertake is planned. All possible uses of concrete, inside and outside, will be covered.

There is a big field awaiting the concrete builder who is equipped to sell his services and to do the work well. Other, less suitable materials are now being used on many jobs where concrete should be used—and where a concrete builder should have had another contract.

It will be the purpose of this new department to point out such possibilities and then to help the builders sell the use of concrete for those jobs, and finally to help him in the practical work of how to build the structure.

Speaking of Merchandising

Changing Conditions in the Building Contractor's Field Show Need for Merchandising—A Large, Untapped Volume of Work Awaits the Contractor Who Goes After It—Contractor Must Adopt Same Methods as Other Business Men—Where Increased Business Can Be Found—Some New Fields

SUPPOSE everyone in your town decided to use concrete wherever possible in remodeling their present homes or for building new ones! "Well," you would say, "I could hardly take care of my share of the new business that would develop. I would want to send one of my men out right away to sign up as many jobs as possible and then get the equipment to put them in."

This is the ideal of the concrete contractor but not an exaggeration. Think of the many new articles and new ideas that are being sold to the public every year. Communication was first sold in the form of letters, then the telegraph and telephone, and now by radio. Transportation has advanced from the sailing ship to the luxurious liner and from the stagecoach to the airplane. The desire for modern comfort has caused the passing of the wooden bench and the advent of the overstuffed davenport; the oil lamp is taboo and electric floor lamps are used.

A Changed Field for the Contractor

Has the same change taken place in the concrete contractors' field? The first homes were built of stones cleared from the fields or of heavy logs cut from trees in the forests. As the pioneers pushed westward, there were no stones in the fields nor forests to furnish logs. Sod houses were followed by those built with light timbers and it was not until almost recently, that concrete in its many forms has been used to build the home and to beautify its setting.

The change has been going on slowly because the concrete contractor has not been working as hard to sell concrete sidewalks, drives, floors and buildings as the furniture maker has to sell overstuffed davenports or the lighting fixture companies to sell three or four floor lamps to replace the old kerosene lamp. These two industries have been talking, writing, advertising and selling for years and their work is bearing fruit.

The Contractor, Also, Must Merchandise

Merchandising is the answer to "How can I build up my present business and open up new fields?" Your future progress will be built on the same plan that Mr. Shoemaker, a cobbler of the colonial period, used with great success. He worked in his shop and sold to all those who came to buy. His son came of age and worked in the father's shop but there was not enough business to keep them both busy and so the son set out on horseback to visit the neighboring farmers and sell his wares. The idea bore fruit, the shop prospered and the business grew. A county newspaper was established and stories about Mr. Shoemaker's product brought more business and the shop was enlarged to take care of surrounding settlements and so on to the establishment of the modern shoe factories.

Increased sales in any business now depend upon successful merchandising. The public has only a certain amount to spend and the question is: "How much of the public's dollar can you get?" Sixty dollars spent for a new concrete sidewalk means sixty dollars less to spend for radios, automobiles, amusements, travel, clothing and what not. You are in direct competition with all other industries as well as with other building materials and the labor required to build them into homes or home improvements.

There's Competition

Let us picture a typical situation. Mr. House now has a dirt driveway leading from the street to his garage. He knows that this driveway is hard to clear of snow in winter, that it is muddy in the spring and fall, that he makes an awful mess every time he washes the car and that the big coal trucks cut deep furrows in the adjoining lawn. He wants a concrete driveway, but he also wants a hundred and one other things. He may have the money to spend, but the chances are that unless you go out to his house and sell him that job he will succumb to a desire that has been created by the intensive merchandising of some other industry.

There are a number of new fields for the concrete contractor that have hardly been touched. Concrete floors are very common in office buildings and hotels and the very characteristics that make them desirable for these two classes of buildings make them desirable for the home. To open up a new market requires considerably more merchandising effort than to sell a market that is established. First comes the educational work, then the advertising to create a desire and then after the way has been prepared comes the salesmanship that gets the business. This does not mean that no effort is required to maintain an old market. Recall what happened in the phonograph industry about four years ago when the radio industry began its phenomenal growth.

Merchandising is a great, vital subject. As applied to concrete, it is intensely interesting. In these pages you will find each month a brief discussion of merchandising problems. You are invited to send in your ideas on the subject and to tell, for the benefit of others, how you have succeeded in selling a job, large or small.

Through aggressive selling the concrete products manufacturers increased their output from 100,000,000 units per year to more than 384,000,000. They hired salesmen and the result was almost four times as much business. The concrete builder can do the same by the same method.

Concrete Floors

—*An Immediate Opportunity for the Concrete Builder*

EVERY industry is casting about for profitable new markets. And, because entirely new markets are very difficult to find, it is necessary sometimes to enter fields that are already served by some other building material.

Such a prospective new market stands ready to be developed by the concrete builder in the concrete floor field. Concrete floors for residences, stores, apartment buildings, etc., present many advantages over the old types. And their costs are not excessive.

In the following article, which is based on a paper read before the recent meeting of the Concrete Reinforcing Steel Institute, W. D. M. Allan presents the facts you will want to know about concrete floors. In it he makes an estimate of the volume of business that may be expected in that field and gives the arguments you can use in selling concrete floors.

Future articles in this section will give detailed instructions on just how to build the various types of concrete floors.

FIGURES prepared by various statistical bureaus indicate that, depending on the various types of buildings placed in the dwelling classification, between 45 and 60 per cent of the total value of contracts awarded fall in a group that is a logical prospect for concrete floors. The Dodge reports show that for 1928, in nine-tenths of the United States, about 204,000 buildings in the residence classification were awarded to contract, containing approximately 120,000,000 sq. ft. of first floor area and valued at about $2,700,000,000. More than half of the residences built in the country are in rural communities and towns too small to maintain building departments. Consequently, most of the published figures do not give a complete impression of residence construction. Referring to the Bureau of Census reports, we find that between 1890 and 1920, approximately 400,000 new residences were built each year. Since 1920 this number has increased considerably and it is conservatively estimated that now more than 500,000 new homes are built annually, with a first floor area of about 300,000,000 sq. ft.

This is part of the market that I am talking about and which is practically unknown to concrete. It is not conceivable that all of this business can be turned to concrete, but certainly a considerable percentage of it can be and at a reasonable sales cost. It is estimated that about 2,000 small residences built in the United States in 1928 had reinforced concrete floors requiring approximately 20,000 cu. yds. of concrete. If all of the first floors in the dwelling classification could be changed to concrete, it would require 5,000,000 cu. yds. Whether or not we get one-tenth of one per cent, ten per cent or twenty-five per cent depends on the amount and quality of sales effort we put into it.

Why Concrete Floors Must be Sold

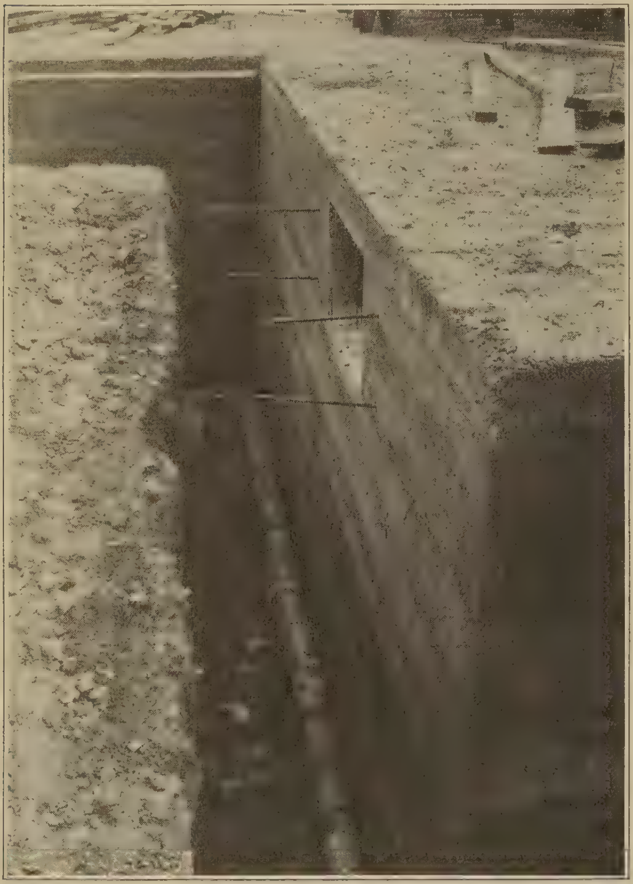
Sales resistance to reinforced concrete first floors for residences falls under the following headings: 1, precedent; 2, appearance; 3, comfort; 4, and most important, cost.

One type of concrete floor treatment. In this room the concrete has been scored and stained to resemble floor tile. A great variety of other floor treatments are possible

Precedent is hard to overcome. Floors for most of us have always been built of wood and the 500,000 annual new home builders seldom think of any other type of construction. The home builder's inclination is often strengthened by the attitude of the architect and contractor with whom he comes in contact when formulating his plans.

Reinforced concrete floors can be just as beautiful as any other type. The term "concrete floor" connotes for the prospect something akin to a sidewalk, admittedly a thing of utility but not to be used in his living or bedroom.

The prospect must be taught that the concrete first floor is primarily a structural floor and can be surfaced just the same as the type with which he is familiar. We must show him surfaced concrete floors and picture how the surfacing is applied; show illustrations of fine hotel and club floors and emphasize that concrete is the aristocrat of floors. He should also be shown that for part of his rooms the concrete can be left exposed, marked off as floor tile and colored or stained and waxed to produce a surface that cannot be obtained in any other way and at a surprisingly low cost.



A concrete floor placed monolithic with the foundation walls. The builder who places the concrete in the foundations can quickly and easily build the concrete floor also

The uninformed think of concrete residence floors as cold and hard and something thoroughly uncomfortable. This is probably due to a hurried trip across the basement floor in bare feet to take care of the furnace on an early winter morning, or from having to stand at work in one place on a concrete floor for hours at a time. Concrete as compared to wood does feel cold to the bare skin and as a material to stand on, but it is not proposed to use unsurfaced concrete where either of these objections could be raised. Put the same kind of covering on the concrete floor that you put on the hardwood floor and one will be as comfortable as the other.

Cost of Concrete Floors

Now we come to the fourth and most important obstacle to sales—cost. We have convinced the prospect that a rigid, durable reinforced concrete floor is comfortable and beautiful and both he and his wife have decided that they want one. They now go to the architect or general contractor and find the house that they have in mind will cost more than they can afford. The trimming process then starts and the contractor suggests that at least $800 can be saved by not using floors of concrete.

Prices for concrete three to five times the cost of other floors are rather the rule than the exception, but every case that we have checked shows that the high price was due to lack of familiarity with concrete floor construction. To sell concrete floors in residences, it is only necessary to keep the costs down as low as a skilled, efficient and sympathetic organization can consistently operate at a fair profit. This is the job of the concrete contractor.

He now leaves the job when the foundation walls are up, usually, to the first floor joists. It is a relatively simple matter for him to place the concrete floors at the same time as the foundations and remove all forms at once after reshoring the floor slab. In many cases he may want to sub the form and reinforcement setting so that all he has to do is place and finish the concrete.

The amount of concrete in any one residence floor job will hardly justify the expense of any one organization doing all of the selling, but if concrete contractors in each community promote this construction, the volume becomes large enough so that equipment and material manufacturers can afford to help through advertising and in some cases sending special men into a community to do general educational work aimed at breaking down sales resistance.

I have said enough to justify my belief that the concrete contractor is a very important factor in putting across reinforced concrete residence floors. The question is then, "How shall we reach this group?" There are between 40,000 and 50,000 of them in business of whom 10,000 to 12,000 are capable of taking on new work.

To reach the leaders, the Portland Cement Association is planning group meetings to be held in every important market. Two series of conferences, one dealing with sales problems and the other with construction methods and quality concrete will be presented. They will be held in the winter months for the most part and each one will require the better part of a day. Usually the sales conference will precede the construction conference; where possible they will be arranged for succeeding days. During 1929, it is planned to cover those cities between 100,000 and 1,000,000 population.

Why Not Contractor's Salesmen?

Very few concrete contractors are, or have, salesmen, but they need them just as much as anyone else in the building material field. The need is to acquaint the contractor with the new lines of work that he can take on and then help him sell. Salesmen should be employed and after they are employed they should be trained. Concrete residence floors can be sold because there are several sound reasons why they are a good and desirable investment. These reasons should be known in detail. Among them are fire safety, low repair cost, high resale value and greater protection against storms.

Fires that originate in basements account for about 30 per cent of the total residence fire loss. Basement fires are particularly dangerous because they travel up through stairways and frequently envelop the entire house before the fire department arrives. In frame and brick veneer houses basement fires get between the sheathing and the plaster easily and the space between the studs acts like a chimney, giving the fire an excellent draft to work its destruction. These fires are particularly hard to fight and are very destructive because the weather-boarding or brick veneer has to be broken through in order to get water on the fire.

The principal sales reason given for reinforced concrete first floors in residences is fire protection. It certainly is an important one, but I question whether the building public is particularly "fire conscious." Do not most folks think of fires like they do of disease or some catastrophe, as something for the other fellow to catch or have, but something they will surely miss? If the fire safety is to have a strong sales appeal, we must strive to awaken a keener appreciation of the fire danger.

Low Upkeep

If I were asked the principal sales reason for a reinforced concrete first floor in a dwelling, my answer would be "low interior maintenance costs that come from rigid floor construction." Nearly every house and apartment built since the war has been constructed of such poor materials or workmanship that the floors have warped and sagged, causing large, unsightly cracks harboring dirt. Baseboards have drawn away from the floor, exposing cracks ranging from ¼ to ½ of an inch in width through which plaster and dirt from the inside of the wall are continually finding their way into the room. Doors and windows that won't close necessitate frequent carpenter repairs. Partitions have shrunk and settled with the floors, cracking wall and ceiling plaster and wallpaper and making what ought to be a new house look like an antique.

Statistics will show that interior maintenance costs at the end of three years will more than pay the difference between a rigid, firesafe, durable concrete first floor and a combustible, non-rigid type. If redecoration in these houses were permanent, the problem would not be so serious but once a crack develops in the plaster redecoration must be carried on every little while and the job never looks satisfactory. Redecoration is becoming a much more important factor than it was in the past. Cracks developing in textured plaster are very unsightly and repair is practically impossible.

Other Sales Arguments

The third strong sales reason for a reinforced concrete floor is high resale value. A reinforced concrete first floor furnishes a rigid, non-shrinking durable base upon which to set partitions that when plastered will remain free from cracks.

Protection against storms and earthquakes furnished a most excellent sales advantage in many sections. The strength of any building depends to a great extent on the rigidity of the floors. In the Florida hurricanes many masonry walls were blown down because they were not cross-tied by rigid floors or partitions. Through the Central West, in what is known as the "tornado zone," rigid reinforced concrete first floors add a great deal of stability to the strength of the wall and the basement furnishes full protection to the family, even in the most severe storm.

World's Fair Village to Show Modern Construction

At a recent meeting of authorities identified with the Chicago World's Fair Centennial Celebration of 1933, it was proposed to build and operate a "Garden Village." The Architectural Commission has agreed to set aside sufficient space within the grounds for that purpose. With the final sanction of the trustees secured, it remains only for competent architects, familiar with community housing projects, to proceed with the details.

According to the tentative plan, the Garden Village would be built to full "life-size" scale and comprise from 12 to 20 homes of most modern construction. There would be a town hall, fire station, stores, school, church, recreational center, parks, playgrounds, and everything necessary to set up a model village; operated as such in accordance with advanced thought.

It is proposed, too, that each home shall be built and furnished by individual business houses or manufacturers, either singly or jointly. Thus the most approved architecture, construction, materials, furnishings and equipment will be co-ordinated into an exhibit that should interest a host of prospective home owners and those contemplating the transformation of subdivisions into towns and villages.

In the upper floors of public buildings there will be space provided for individual exhibits and demonstrations of builders, manufacturers of building materials, equipment, etc.; these to supplement the purely scientific and industrial expositions of the main part of the World's Fair.

Burial Vault Manufacturers Start National Advertising

Concrete burial vault advertising, such as is now appearing nationally in the undertaking trade papers, saw its inception at the meeting of the Ohio Concrete Burial Vault Manufacturers Association at Columbus, Ohio, in February, 1929.

Several manufacturers from outside of Ohio also attended this gathering. Among these was F. H. Van Ness of the American Vault Company, Brooklyn, N. Y. Mr. Van Ness strenuously advocated the advisability of national advertising to popularize concrete burial vaults and induced manufacturers present to join with him in creating a fund to defray the expense of a national campaign.

UNDERWOOD & UNDERWOOD

Concrete in perfect condition after 1900 years

In building the Pantheon, at Rome, Italy 1900 years ago the Romans used concrete for the foundation walls and dome. This is the only ancient edifice at Rome which is still in perfect preservation as regards the walls and vaulting

You can depend upon a properly made concrete burial vault giving absolute protection for centuries. Properly made concrete is not affected by destructive underground elements. When you think of concrete, think in terms of centuries of absolute protection—not twenty-five or fifty years.

CONCRETE

BURIAL VAULTS

Concrete for Permanence

The Ideal of an Industry

Introduction

> Editor's Note: This is the first of a series of brief articles to appear on this page each month, in which Mr. McMillan will discuss those factors which make for durable concrete. The articles will be illustrated by examples taken from structures now being examined in a nation-wide survey.

By F. R. McMILLAN

CONCRETE for permanence should be more than a slogan; it should be the ideal of the concrete industry. While nothing is permanent in the literal sense, enough has come down to us from the monumental works of our early civilization to show that among the works of man, reasonable permanence is attainable. With this experience in view, it is not too much to expect of the concrete industry a realization of the ideal—permanence.

The responsibility for the realization of this ideal should not rest solely with one unit of the great concrete industry—the cement manufacturer. It should be borne equally by those groups which have, or at least should have, the same concern as the cement producers in obtaining a successful structure—engineers, contractors, architects, owners, and aggregate producers.

In this series of articles, it is proposed to develop, by laboratory data and field experience, the principles which, if put into daily practice, will achieve concrete of the greatest possible endurance.

Factors Affecting the Durability of Concrete

Concrete, defined in the simplest terms, is a mass of aggregate thoroughly incorporated in a cement-water paste which hardens through the chemical action of the cement and water. With this definition in mind, it is possible to develop rather clearly the factors involved in making concrete that will successfully resist the destructive forces of weathering. So far as the concrete itself is concerned, it follows directly from the definition that three conditions must be fulfilled. The aggregates themselves must be weather resistant, the hardened paste must likewise be weather resistant, and the aggregate and paste must be combined in such a manner that the resultant mass offers the least possible opportunity for the attack of the weathering agencies.

With aggregates which are weather resistant the most important requirement for concrete to resist weathering is that it shall be watertight. Concrete behaves as do the natural rocks when exposed to weathering agencies in that it is susceptible to freezing and thawing of entrapped moisture. While there is much to be learned in reference to the action of these natural forces, such information as is available from research and experience points to the conclusion that the more watertight the concrete, the greater the resistance to these destructive agencies. Thus, we find that the problem of producing durable concrete resolves itself primarily into 5 major subdivisions.

1. The selection of aggregates that are watertight and durable.
2. The making of a cement-water paste that will be watertight when hardened.
3. The proportioning of aggregates and paste to give a mixture capable of complete incorporation into a watertight mass.
4. The mixing, transporting, and placing in such a manner that the concrete will be uniform and homogeneous.
5. The protection of the finished structure to insure adequate curing.

Leech Lake Dam, Minn.—An example of concrete after 26 years of severe exposure. Built in 1901-2 by U. S. Engineers Corps at Leech Lake Dam, Minn.

In addition to these divisions of the problem, which relate to the concrete as a material, there remains the problem of the design of the structure which must receive equal consideration. Such factors as arrangement of construction joints, spacing of the reinforcement, type and details of embedded fixtures, provisions for drainage, sequence of operations in placing the different units of the structure, provision for loads and other structural requirements, if not properly cared for, have an important bearing on the life of the structure. Consideration of these, as well as the selection of aggregates, will be deferred until the other factors involved in the making of concrete, which are so intimately related, have been fully treated.

The next two installments will deal with the making of a watertight paste.

Painting Decoration on Concrete

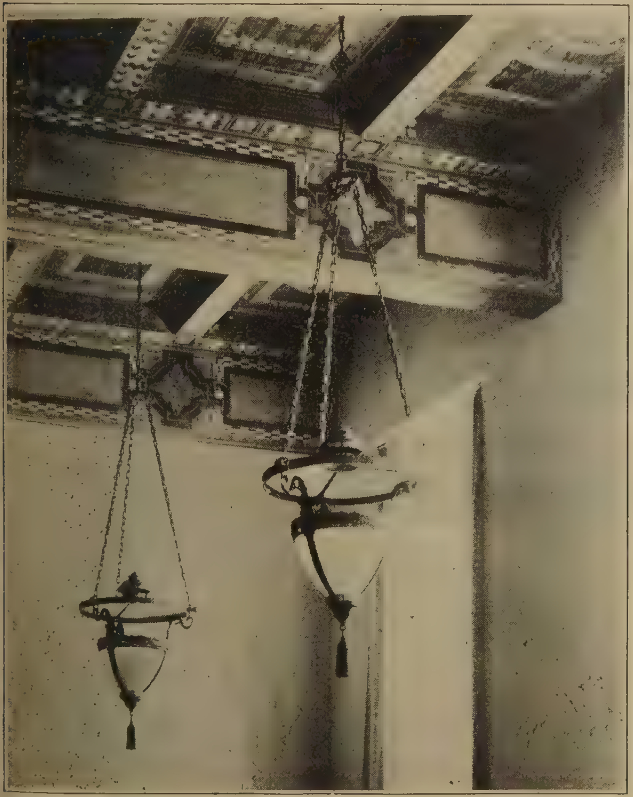
Practical Instructions for Applying Oil Paints to Concrete Surfaces—Preparing the Surface to Receive the Paint—Base Coats—Applying the Stain—How to Protect the Painted Surface

By W. E. HART

THE many changes being made in the exterior treatments of buildings today naturally call for a change of treatments on the interior, particularly in lobbies, lounging and dining rooms of clubs, hotels and public buildings. Many architects now realize the possibility of including the structural members of a building in the architectural or decorative scheme. In other words, concrete beams and girders may be so designed and constructed as to become integral parts of the decoration.

It is essential that the identity of the concrete is not lost by the film of paint. The texture characteristics of concrete should predominate after the decoration has been placed. It is, therefore, suggested that the surface of concrete be stained rather than painted. Stenciled decorations may then be placed upon the soffits of beams with colored paints in order to produce a pleasing ensemble.

By staining and painting concrete surfaces, a great variety of decorative effects can be obtained. After the concrete surfaces have been prepared in the proper manner, many stains, paints, enamels and varnishes may be used for decorations which range from the simplest stenciled designs to the richest and most elaborate for murals. In the following paragraphs the essential requirements for obtaining satisfactory and durable decoration on concrete are enumerated. It must be pointed out, however, that definite specifications or instructions can only supplement, and not replace, the knowledge and technique that are acquired by long experience. It is, therefore, recommended that the application of decorations on concrete be entrusted only to workmen who have had the necessary experience.



Painting directly on concrete beams and girders enables the architect to include the structural members of a building in the decorative scheme

A great variety of decorative effects may be secured by staining and painting concrete surfaces. This is the rotunda in the new Los Angeles Public Library

Preparing the Surface

When a decorative scheme is to be achieved by the staining and painting of concrete, it should be realized before the concrete is placed that the final effect will depend largely upon the quality of the surface on which the decorations are applied and therefore, satisfactory textures and freedom from blemishes should be secured by especial care in the selection and preparation of the form lumber and in the placing of the concrete. The number of textures that can be secured on concrete surfaces is limited only by the skill and ingenuity of the workmen who prepare the forms.

Too much emphasis cannot be laid on the thorough drying of all concrete work before painting is started. It should be remembered that all concrete structures contain considerable water when new and although concrete may appear dry it may still contain much moisture just under the surface. Sufficient time under the proper conditions of temperature and humidity must be allowed for drying or the moisture in the concrete will eventually injure an oil-paint coating. It must be realized, however, that concrete should not be permitted to dry until after a proper period of curing has ensued. The concrete must be kept damp during the first week or ten days after placing in order to assist the chemical reactions which give to the concrete its strength and its durability.

Concrete on which painted decorations are applied must, of course, be free from infiltration of moisture from the outside.

Preliminary Coats

The staining or painting of concrete should be preceded by the application of an aqueous solution of zinc sulphate (4 pounds of crystallized zinc sulphate to one gallon of water) in order to neutralize any lime that may have been deposited on the surface as a result of the chemical action that takes place during the hardening of concrete. If lime is left on the surface, in the presence of moisture it will tend to saponify the linseed oil in the stains or paints that are subsequently applied. By tinting the zinc sulphate solutions with pigment color the danger of leaving untreated areas can be avoided.

Sufficient time—at least 48 hours—must be allowed for the neutralizing action and drying of the zinc sulphate solution before the addition of other material to the surface.

The zinc sulphate treatment is simple, effective and comparatively inexpensive, and it does not affect the most delicate paint pigments. Prominent interior decorations and research chemists recommend the use of an aqueous solution of zinc sulphate for preparing concrete surfaces to receive oil paints.

The Priming Coat

The next operation should be the application of a priming coat which partially fills the pores of the concrete and prevents the stain or oil paint from penetrating too deeply. A primer consisting of boiled linseed oil has proved satisfactory. By filling the pores, it reduces the suction of the concrete so that the oil and pigment in the paints are not separated. Some pigment color should be added to the boiled linseed oil primer in order to avoid leaving untreated areas. If the concrete is dense it may be necessary to add turpentine to the linseed oil in order to secure the correct amount of penetration.

After the priming coat of boiled linseed oil has dried the concrete surface is then ready to receive the stains.

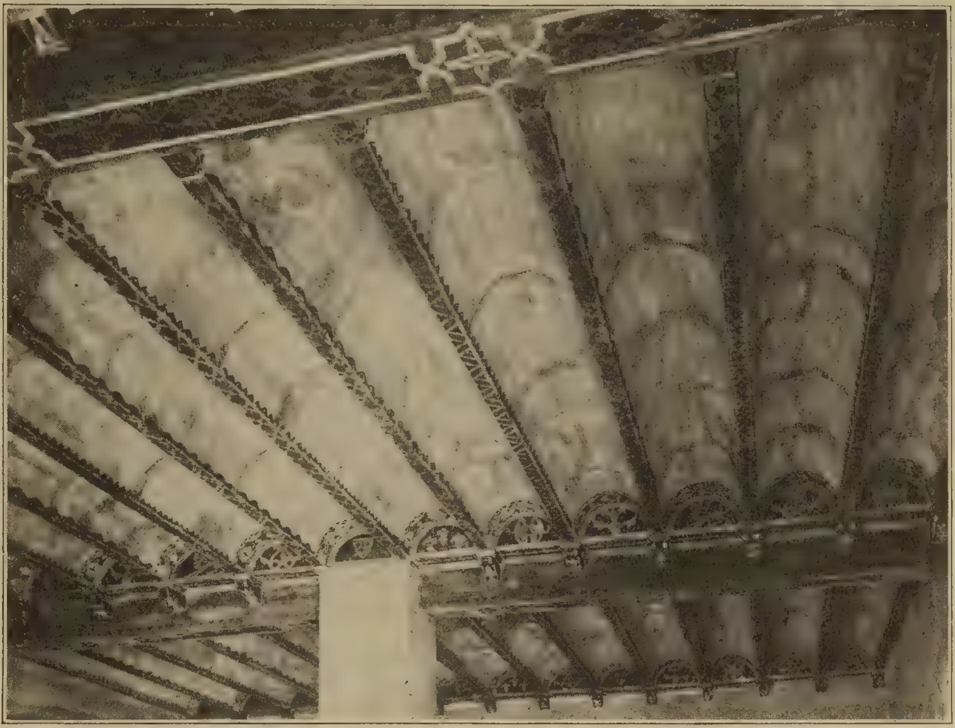
Applying the Stains

The most satisfactory and attractive decorations have been obtained by staining the entire surface and then applying paints only to small areas of brilliantly colored stenciled designs. By this treatment the textures of the concrete in the stained areas are seen plainly and become an integral part of the decoration.

Stains consisting of a mixture of boiled linseed and Chinawood oils, thinned with turpentine or naphtha and colored by pigments have proved satisfactory for use on concrete. A high grade linseed oil paint can be used as a stain if it is thinned sufficiently.

Many stains, paints, enamels and varnishes may be used for decorations which range from simple stenciled designs to elaborate murals

When the stains have dried, the stenciled decorations may be applied with paints. The formula of the paint may be adapted to the character of surface desired and the porosity of the concrete to which it is to be applied. Various combinations of white lead, lithopone, zinc oxide, titanium oxide and inert pigments mixed with either linseed oil or heavy-bodied enamel liquids have given excellent service. Tinting pigments should be alkali-proof and, of course, light-fast. Ready-mixed paints made by



Painted decorations applied directly to a concrete ceiling constructed with the pan system

reputable manufacturers especially for the painting of concrete surfaces can generally be relied upon to give satisfactory results.

Protecting the Painted Surface

To protect the painted surface, thin, clear varnishes or shellacs are often applied. By their use a glazed surface may be produced or an antique effect may be given to an entire color scheme. An additional protection that assists greatly in the cleaning of the surface is a coating of starch. When such a coating is removed by washing, any accumulation of soot or dirt on the surface is also removed. Afterwards, the surface may be recovered with a fresh coat of starch. The addition of such protective coatings, of course, increases the economy that is obtained by the staining and painting of decorations directly on concrete.

Stenciled designs on ancient walls and ceilings can be revived and placed in modern buildings with the assurance that they will be economical and as permanent as the ancient examples from which they are drawn. In concrete a new field is opened for building decoration, both interior and exterior. Furthermore, modern processes of making concrete exercise no restraint upon the architect, but on the contrary, this material affords a greater freedom in design than any other building material.

Industry Urged to Exercise Caution to Reduce Toll of Accidents

As one of those contributing to industry's annual accident bill of $100,000,000, the construction industry was urged to exercise constant watchfulness, in a radio address by Hon. Robert Lamont, Secretary of Commerce, on Saturday evening, May 11th.

Mr. Lamont viewed the nation's accident prevention work not only through the eyes of a government official, but also as a leading engineer and one who has had long and intimate experience with the safety problem in the industrial world. He said, in part, "Innumerable 'standards' developed by our Bureau of Standards bear directly on the furtherance of industrial and traffic safety.

"Yet, in some of the specific fields where gratifying results have been attained, the government lacks definite regulatory powers, having no authority to enforce its recommendations calculated to promote safety. Ultimately, we must rely in most cases on the individual.

"Reliable safety experts tell us that 98 per cent of all accidents can be avoided. That's why we say that 95,000 fatalities annually are caused by 'so-called' accidents.

"Develop and inculcate care! Resolve to exercise discretion, caution, constant watchfulness. Train yourself to avoid instinctively all heedless, rash exposure to unnecessary risks. Remember that to miss a minute is infinitely better than to maim a member or to lose a life.

"If you are operating any mechanism that is capable of inflicting deadly injury, cultivate consistent vigilance and prudence, so that you may escape all troublesome involvement, material liability, ineffaceable consciousness of guilt.

"And, in addition, I appeal to you to ally yourself with all such forces, all such organizations, as are working publicly and co-operatively for safety. Adhere to the standards they establish."

On May 25th, Dr. John H. Finly, editor of the "New York Times," talked on "Education—The Part It Plays in Safety." On June 1st, Dr. Miller McClintock, director of the Albert Russell Erskine Bureau of Street and Highway Research, Harvard University, was to discuss "Making Our Highways Safe."

The balance of the program that is of particular interest is as follows: June 8th, Grover A. Whalen, New York commissioner of police, "Enforcement as an Aid to Safety"; July 6th, Hon. Jas. J. Davis, Secretary of Labor, "Safety and the Worker," and July 13th, a general summarization of the entire safety problem as it confronts the individual, the speaker of which is not yet announced.

New Work for the Contractor—
Garden and Ornamental Pools

Detailed Instructions on How to Build Garden and Ornamental Pools of Concrete—Another Opportunity for the Concrete Builder to Enlarge the Volume of His Work—Some Typical Designs

THE progressive concrete builder will undoubtedly be called upon to build or to give advice concerning the details of garden pool construction. Such structures provide a worth while opportunity for enlarging his activities. Many home owners are prospects, if the contractor calls the attention of the home owner to the fact that he is able and ready to construct such pools.

How large to make the pool, the best location, the reinforcement, these and other pertinent questions will be put to him. It is the purpose of this article to present information that will enable him to answer these essential questions in ornamental pool construction and to undertake their construction.

The Size and Depth of the Pool

The first things to be decided in considering the construction of a pool are the size and shape. The size is somewhat dependent upon the type of plants to be grown. For instance, small species of water lilies will require a pool only 3 ft. in diameter. There are larger varieties that need more space.

The depth to make the pool is likewise dependent upon the type of planting and the climatic conditions. Water lilies require a depth of 22 to 24 in. Pools that are shallow are likely to freeze solid in winter and the plants are thus subjected to this danger unless precautions are taken to guard against freezing. It is particularly important to have a deep pool in climates where severe winters prevail.

The usual method of preventing an excessive thickness of ice from forming over the pool is to board it over and cover with straw and leaves. Goldfish should always be removed from the pool in winter, but lilies will not be harmed if the ice does not form deeper than 2 or 3 in.

The choice of size and shape for a concrete garden pool will to a large extent be influenced by its location. For instance, if the pool is to be the center of a garden or lawn, either of which is developed along formal lines, it is more fitting to select some type of square or round pool that would have a pleasing relationship to the lines of the paths and borders about it, thus making the pool incidental to the general design. Regardless of the shape, it is best to have the pool where it will receive full sunlight.

Ornamental pools are often constructed on the roofs of apartment houses and hotels. When built in such locations they vary in size as do the lawn or garden pools. They are often highly ornamental and may be surrounded by benches, bird baths and other garden furniture.

Construction of a Garden Pool

Attractive designs for garden pools are shown in the accompanying illustrations. Variations of these designs may be readily adapted to suit the conditions of the job. Thus, the curved ends shown may be eliminated, or the plans altered to fit other dimensions.

The first step in the construction of a garden pool resting on the earth is the excavation. Then comes the form construction. If the soil is firm, no outside forms are needed, but with loose, crumbly soil both inner and outer forms will be required and excavation will have to be larger to permit construction of the outer form. If forming is required for the rounded ends of the pool, sheet steel bent to the desired shape should fill the requirements. Outside forms of this nature may be left in place after the concrete work is completed.

The pool structure should rest on well compacted ground. A 6-in. cinder or gravel fill as a base is recommended to insure good drainage beneath. After the base has been prepared and forms put in place, the steel reinforcement is located ready for placing of the concrete. If mesh is used for reinforcement, the sheets can be cut to the desired size, wired and bent to shape. When rod reinforcement is used, it is well to wire the pieces together as they will be placed on the job, for ease in handling.

Concrete for the floor should preferably be placed first and immediately afterwards the walls should be built. By making the entire pool in one continuous operation, joining seams in the concrete are eliminated. The pool must be watertight, and building it all in one operation helps to secure this important quality.

After the floor has been placed the interior form is put into position ready for the concrete walls. Faces of forms may be oiled or soaped to facilitate removal.

Concrete is deposited in 6- or 8-in. layers in the wall forms. It should be well spaded and tamped. A garden hoe that has been straightened out makes a good tool for spading the concrete. Care should be taken not to displace the reinforcement while spading.

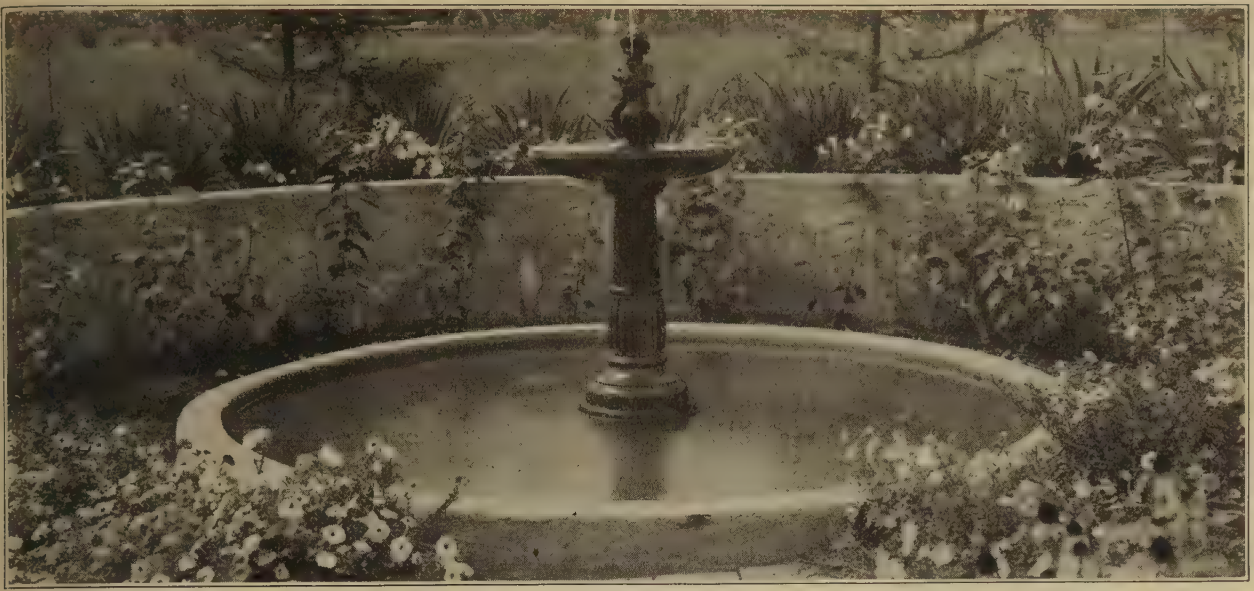
In cases where lilies are to be grown in the pool, and tubs in the bottom are not desirable, several circular pits 10 or 12 in. in diameter may be provided in the concrete floor. The walls and floor of such lily pits should be the same thickness as the pool floor.

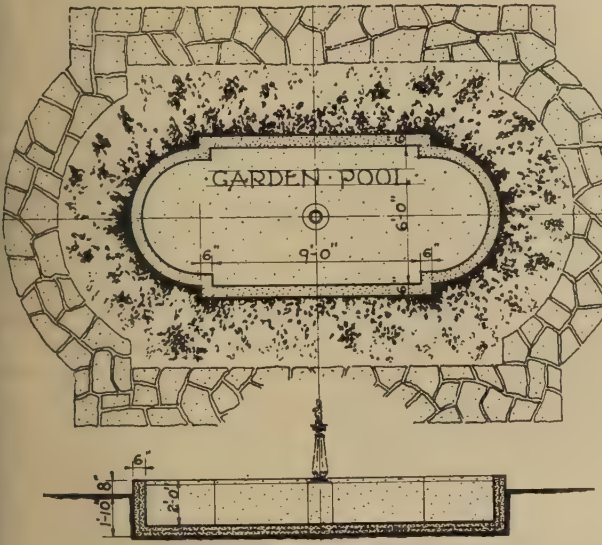
Finishing the Pool Around the Top

Sometimes it is desirable to have a concrete curb or coping around the pool for decorative effect. Cast stone, concrete roof tile, and other precast units provide excellent trim. In the larger and irregular-shaped lily pools, rocks and boulders placed around the margin often provide the desired natural setting and bring the pool into harmony with its surroundings. The rocks should be set in a full bed of cement mortar.

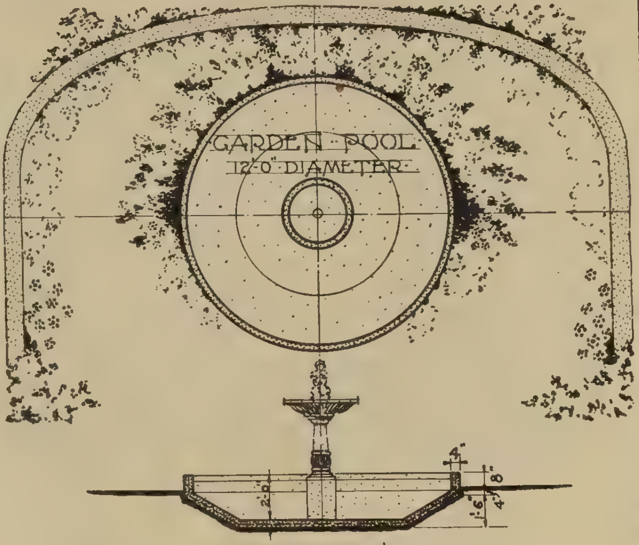
Water Supply

All plumbing connections for the concrete garden pool should be made before the concrete is placed. It is well

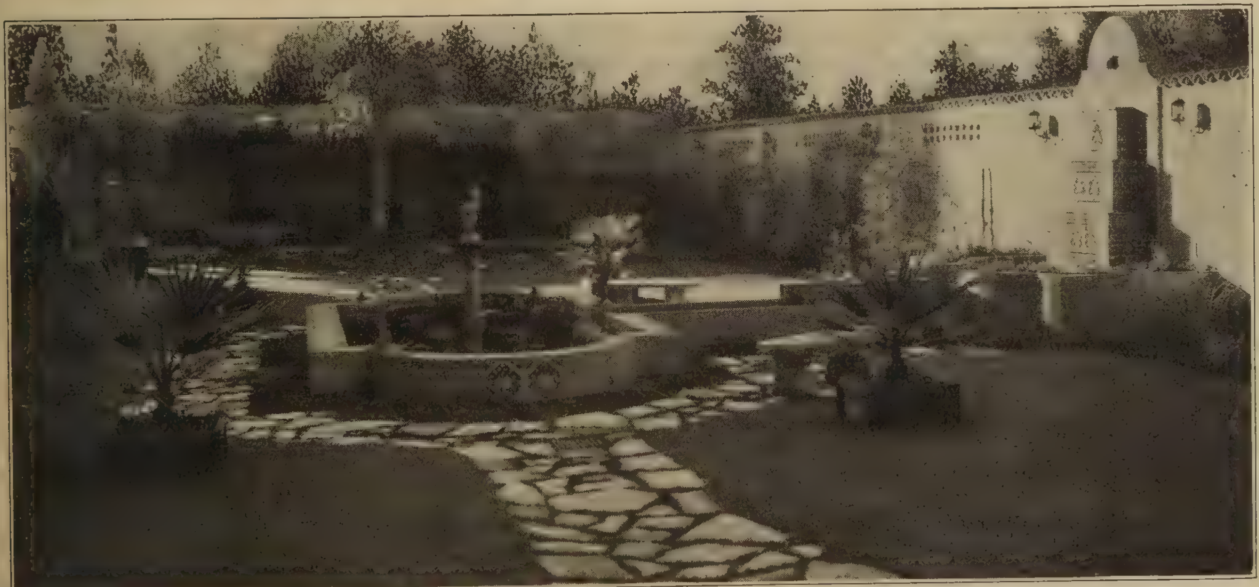




SECTION
PLAN OF POOL SHOWN BELOW



SECTION
PLAN OF POOL SHOWN ABOVE



to provide facilities for emptying the pool, thus relieving the owner of the task of siphoning. A drain in the bottom is recommended and it can also be utilized as an overflow pipe by use of an extra length of pipe coupled into the drain. For convenience in detaching do not screw the drain pipe in too tightly. It is well to cover the outlet of the overflow pipe with a wire netting to keep out foreign objects which might clog the pipes.

Running water often is desirable, especially if the garden pool is to have a fountain. Lily pools do not require running water. If running water is to be provided, regular pipe connections should be put in, otherwise water can be run into the pool with an ordinary garden hose.

Provision for Growing Semi-Aquatics

Bog gardens, a form of concrete pool, are often desirable for the growing of semi-aquatic plants. Japanese iris, a popular plant of this type, requires such a garden for its proper growth. To construct a bog garden, excavate to a depth of 16 to 24 in. and build a reinforced concrete box with walls 4 in. thick. When filled with rich soil such as old turf mixed with well rotted cow manure, such a concrete box will provide its owner with the desired facilities for growing semi-aquatic plants.

How to Make Watertight Concrete

Concrete for the garden or ornamental pool must be watertight. If the mixture is designed and controlled to get every particle of sand and pebbles coated with the cement paste, an important step in securing watertight concrete has been taken. Admixtures, designed to increase the watertightness of concrete, are often used for this purpose. The use of too much mixing water thins or dilutes the cement paste, weakening its cementing qualities. It is important, therefore, that cement and water be used in proper proportion to get best results.

For garden pool construction, the recommended mix is one containing 5½ gallons of water per sack of cement (when sand and pebbles are dry) plus such amounts of sand and pebbles as are needed to produce a workable mix. (When sand and pebbles are moist, use 4¼ gallons, and only 3¾ gallons when sand and pebbles are dripping wet.)

For a trial mix use sand and pebbles in the proportions of 2 cu. ft. sand and 3 cu. ft. pebbles per sack of cement. If this results in a mix that is too wet, add sand and pebbles until the right degree of workability is obtained. If the resulting mix is too stiff, cut down the amounts of sand and pebbles in the next batch. Proportions should be controlled in succeeding batches to produce a workable mix that will place and finish well.

Curing the Concrete

Forms are removed about 48 hours after concrete has been finished. Do not allow the new work to dry out. Protect it from sun and wind for a week or ten days and keep it moist by occasional sprinkling.

Putting the Pool Into Service

The completed pool should be filled with water and emptied several times during a period of at least two weeks to remove any traces of alkali which if present would injure plants or fish. When this has been done the pool is ready for use.

Temperature and Humidity Effect on Concrete Defined

The extent to which modern concrete structures are affected by temperature, humidity, stress and plastic yield was explained by Dr. Oscar Faber in a recent lecture before the Royal Institute of British Architects in London. Impervious materials represented by the metals, such as steel, said Dr. Faber, changed their length by change of temperature and by change of stress. Thus steel expands approximately .000006 in. per in. per deg. F. rise in temperature, the expansion being practically proportioned to the temperature change.

Dry and seasoned concrete expands with temperature rise very much as steel, and with practically the same coefficient. A reinforced concrete viaduct at Sittingbourne, England, is 2,400 ft. long, which would represent an expansion of 8½ in. This would clearly be very destructive if unprovided for. Actually the viaduct was divided into 100-ft. sections, with expansion joints between. The gaps were found to be about ⅜-in. less at 3 p. m., after exposure to a hot sun, as compared with 3 a. m., on a cold, clear night. This is in close agreement with the previous figure. The force of this expansion is enormous.

At one stage in construction a granite pebble became wedged into the joint in the morning and resisted the expansion, with the consequence that after mid-day a large piece of deck was blown off with a loud report.

In the case of porous but seasoned materials change of humidity produces change of length. Timber, however long seasoned, will absorb moisture and expand if immersed.

A structure composed of seasoned precast blocks is less likely to crack than one of in situ concrete, because while both are subject to contraction with drying and cooling, the in situ has the shrinkage in seasoning additionally. There is also another reason for the superiority. When concrete sets, the chemical action produces heat and rise of temperature. In this connection Dr. Faber mentioned an experiment which has been made in the building of the new Bank of England. In the bank underpinning there is a retaining wall 8 ft. thick of ordinary concrete. A thermometer buried in the heart of this indicated a rise of 50 deg. F. in three days (from 50 deg. to 100 deg. F.). With some much richer concrete for strong room construction the temperature rise was approximately 100 deg. F. (from 50 deg. to 150 deg. F.).

Dr. Faber remarked that his observations were not intended as criticism of reinforced concrete.

"Reinforced concrete," he said, "can be designed to meet all the conditions required, but it is often designed without much regard to them, especially in commercial competitive designing, and then cracks result and sometimes decay sets in."

Survey System in America

With the growth of the quantity survey system it is interesting to know something of its beginning.

Its introduction in America is said to be due to G. Alexander Wright, a San Francisco architect. He is said to have worked with the project from 1890 to 1925. The American Institute of Architects first seriously considered its adoption in 1915 and seven years later took it up. The Associated General Contractors of America and the Federated Engineering Societies followed.

New P. C. A. Highway Bureau Head Appointed

E. M. Fleming has been appointed manager of the Highways and Municipal Bureau of the Portland Cement Association with headquarters at the general office in Chicago, effective since March 15th. He succeeds L. S. Trainor, who resigned January 1st.

Construction Methods and Form Details

(Continued from page 14)

the engineers had planned to drive a 3,500-ft. tunnel, but the contractor ran into such bad ground that he drove 4,455 ft. of tunnel before finishing his contract. The sewer through this tunnel is 57 in. in diameter and is built of segmental tile block backed with concrete which fills all the excavated space. Most of this tunnel passes through hard clay or shale and occasional limestone. Work was started from both ends from shafts about 50 ft. deep. Not a great deal of timbering was required except where the tunnel entered a quicksand vein. The contractor, fearing that the segmented tile would not withstand the pressure of the soil, encased the tile in a ring of 12-in. concrete of 1:2:4 mix using a dry mix.

Sewer Line Carried on Trestle

The most interesting feature of the sewer line is the 2,100-ft. trestle aqueduct on the west side interceptor. This section of the line lies adjacent to the river and crosses over Spring creek. The sewer is 66 in. inside diameter throughout the aqueduct. It is the intention of the city to make this part of the sanitary district land into a public park, so the engineers designed a structure of attractive appearance as well as for serviceability. The barrel of the pipe is octagonal in shape with a smooth exterior finish.

The aqueduct is carried on a series of piers spaced 45 ft. center to center. This width of spacing made it necessary to build structural strength into the sections in order to withstand the weight of the full sewer as well as the weight of the sections. The sections are heavily reinforced to act as a beam and hoops are installed to prevent any flattening action.

The entire line of the aqueduct lies on low ground, subject to overflow, so that the concreting plant had to be erected upon high ground some distance from the line and concrete and other materials transported by industrial railway to position. Work on the piers was mostly done in winter weather, only four piers being erected in warm weather. The pier excavations averaged 4½ ft. in depth and were so wet that each excavation had to be connected to a sump and a pump to keep out water.

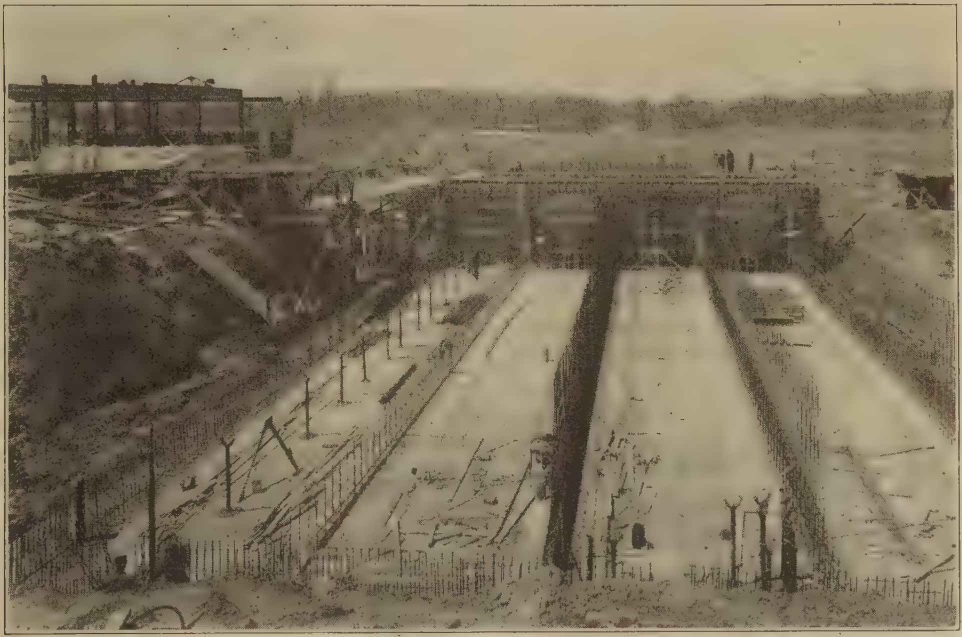
Each pier consists of two concrete legs resting either on a spread concrete foundation or on piles. The posts in general were about 11 ft. high and outside sections of each post were carried up to form a cradle for the aqueduct pipe. These posts were capped with a concrete arched beam. The contractor used only two sets of forms for all 45 piers. As much of the pier work was done in winter, precautions against freezing had to be taken. During the winter the contractor arranged his schedule so that only one pier was built each day. A collapsible wood house was erected around the pier and kept in place 24 hours. Salamanders installed within the house furnished heat during the first 24-hour period while the forms were left in place for 48 hours.

The mixer was equipped with an oil heater and all materials were turned for three minutes to insure thorough and adequate heating. When the water of the river was normal, a portable mixer was used for some of the piers. Materials for this mixer were piled alongside the piers. During high water the mixer on high ground was used, the heated concrete being transported to the forms in an industrial car holding six batches and pushed by hand. When warm weather came the contractor built two piers a day.

In building the barrel of the sewers between the piers the contractor drove five bents of piling between each set of piers. When the outside forms were erected a floor system was built on top to carry the industrial railway which brought the concrete.

The barrel is heavily reinforced with 14 longitudinal bars in the bottom, 108 transverse bars in the top and bottom and 54 hoops in each section, all tied to longitudinal temperature bars spaced 18 in. center to center. The lower quarter of the barrel was cast first using a 1:2:4 mix of dry consistency. The mix was made dry enough so that the invert could be formed with a screed and without use of inside forms. A construction joint was made at the top of the invert.

When the concrete of the invert had set for 24 hours, the inside forms were placed and bolted to the outside

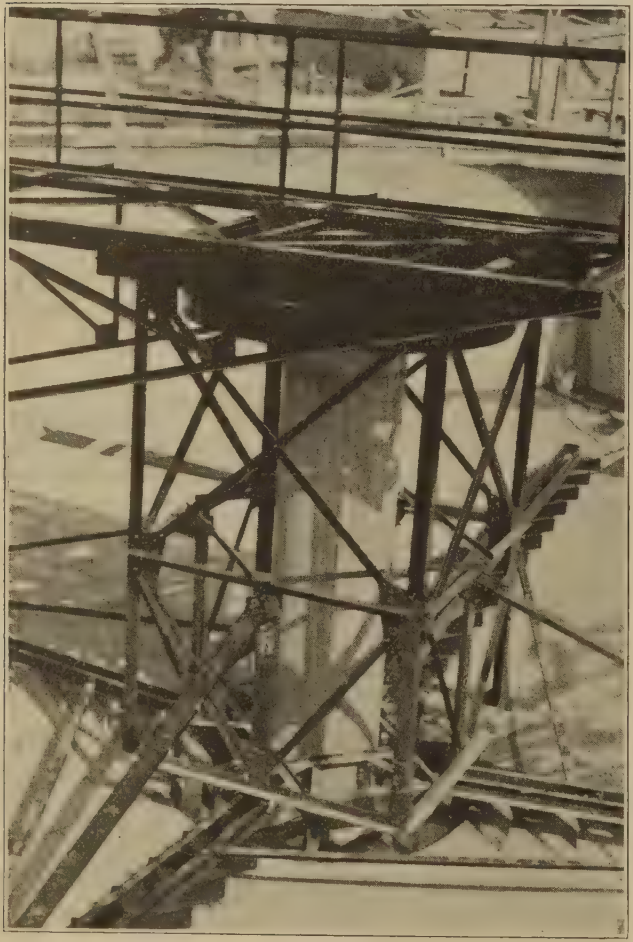


The areation tanks at the sewage disposal plant, showing floors after casting. Butt joint between the wall and floor is mortised and bonded with cement grout forms to keep them in exact position. The bolts were later removed and the holes plugged with concrete. The inside forms were left in position for 24 hours. After three days the outside forms were removed and the industrial railway track run on the exposed barrel.

A Watertight Concrete Needed

The concrete for the barrel below the construction joint was a 1:2:4 mix with a water content of 5½ gallons of water per sack of cement. Gravel was used for coarse aggregate. Above the construction joint, 7 gallons were permitted. Every precaution was taken to get a concrete without voids or honeycombing. The concrete was spaded thoroughly around the steel and very little excess water was brought to the surface. The concrete in the batch cars was spaded to prevent segregation. In placing the concrete above the construction joint, concrete at the joint was cleaned and given a coating of rich cement mortar. Concrete was then deposited and forms left in place for three days. After removal of the forms the exterior was rubbed with a carborundum brick and sprinkled five times a day for two weeks to insure adequate curing. In testing the barrel for watertightness later, no leakage was discovered.

Above each pier an expansion joint is placed in the line. The end of one section of the barrel is anchored to the pier cap by a tongue of concrete, while the end of the adjoining section rests on a two-piece expansion bearing, one piece embedded in the barrel and the other in the pier cap. Between the sections of the barrel three ½-in. layers of bituminous felt are placed around a coppe diaphragm with bituminous filling.

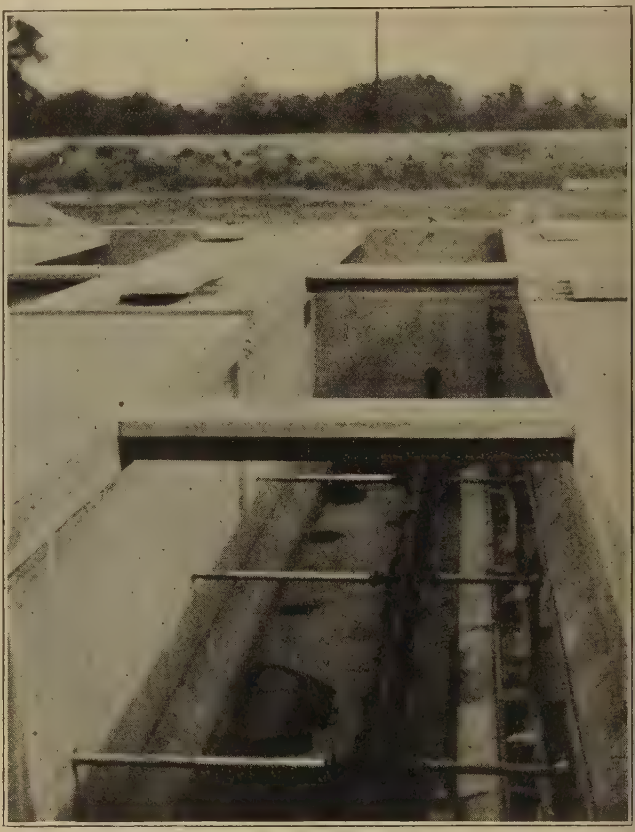


One of the concrete support columns for clarifier in the primary settling basin. The post is monolithic which in turn is part of the floor

The sections of the aqueduct were tested for deflectio both under dead load and under imposed load. Unde dead load the deflection at the center was found to b 0.133 in. and under loading of a 7,000 pound locomotiv and a 4,000 pound car of concrete the additional deflectio was 0.005 in. at the center of the span.

The Treatment Plant

The sewage treatment plant utilizes two methods o treatment—activated sludge followed by separate sludg digestion. This type of plant uses considerable amount of electrical energy, but was chosen because the prevailin rate for current in Springfield is exceptionally low.



The interior of an aeration chamber. Air introduction plates to be embedded in right side of tank in floor

The sewage coming in through the interceptors firs flows through a grit chamber, which is a concrete basi containing coarse screens to catch floating debris. Th basin is designed with narrow channels and weirs to retard and make uniform the flow of sewage so that heav solids like gravel will settle to the bottom of the chambe The chamber and screens can be cleaned easily. Practically none of the organic sewage is collected in the gri chamber.

From the grit chamber the sewage passes to primar settling basins. These basins are of concrete, rectangula in shape and built below ground level. Each tank is buil to have a capacity sufficient to hold sewage for 45 minutes The velocity of the sewage here is so slow that all th heavier suspended solids settle to the bottom of the tank Dorr equipment skims the solids off the bottom to th center of the tank. The design of the plant calls for a 3 per cent removal of organic solids in these primary tanks

The partially clarified liquid passes from the primar settling tanks to the aeration chambers. In this plant ther are four of these chambers all contained within a large rectangular concrete basin.

Excellent concrete work was secured in all the tank work. The chambers have a sloping toe section and an overhanging top. The partially clarified sewage is held in the aeration tanks from 6 to 8 hours, depending upon the concentration of the sewage. While in the chambers the sewage is agitated by air introduced under high pressure and subjected to bacterial action from sludge reintroduced from the final settling tank. The plates through which the air enters are embedded in the floor to one side. The combined action of the air and the activated sludge sets up organic action which completely separates the organic contents of the sewage and prepares the sewage for final settling.

The final settling tank is a square concrete pit equipped with another Dorr clarifier. The sewage already prepared for settling remains in this tank for a sufficiently long period to insure settling out of the remaining 65 per cent of the organic matter. The sludge as it settles on the bottom is scraped to a central outlet from which it is taken to the sludge digestion tanks.

On all of the tank work a 1:2:4 mix was used. The coarse aggregate was both crushed and pit gravel, cleaned and properly graded to insure a smooth, uniform concrete. The contractor used wood forms which were cleaned before placing concrete. While the concrete was not designed to a strict water-cement design, the specifications permitted not more than 6 gallons of water per sack of cement.

The materials for the batches were proportioned by volume. A water measuring device was used on the mixer to insure constant water content. All materials were turned for 1½ minutes. The slump test was used as a measure of the consistency and the aggregates with the 6-gallon water content produced a sluggish concrete. For most of the work the contractor found this water ratio easy to place, but on thin sections the concrete had to be well spaded to work in around the reinforcing. This working brought a rich mortar to the surface, a condition which accounts for the clean and dense surface of all the concrete units.

The sludge digestion tanks are interesting features of the plant. These tanks are located at some distance from the basins and are grouped together to form a closely knit group of four tanks. These tanks are elevated so that sludge can be removed through doors at the bottom. The tanks are circular and have sloping hopper bottoms. The sludge will remain in the tanks for several months, during which time the sludge undergoes decomposition until it is rendered odorless and harmless. Two of the tanks will be equipped with gas collectors so that the gases can be used to fire furnaces in the plant.

The tanks were built with wood forms. The forms were set for the lower part of the tank, then raised and secured in position. Care was taken during all casting operations to see that the concrete was worked thoroughly into the forms and around the reinforcing and that no air or aggregate pockets formed in the shell. The concrete was brought from the mixer to a pit in which the bucket of a crane was lowered. When the bucket was filled the crane swung it to position.

The last unit in the process of treatment is the sludge drying beds. The sludge in the tanks is wet and before the sludge can be disposed of, either for filling in low land or sold as fertilizer, it must be dried. These beds are of sand, ¼-in. to ⅞-in. gravel and rock ⅞ in. to 2 in. underlaid with drains to carry off the liquids. Eight beds are now in operation with a capacity for drying sludge from a population of 60,000. The beds are divided by low walls composed of slotted posts between which precast concrete units are placed. Two of the beds are glassed over as an experiment. This glassing over keeps the drying sludge from the elements, which in winter time retards drying. The glass houses also serve to increase interior temperatures in cold weather.

The entire plant and sewer system was planned by Pearse, Greeley and Hansen of Chicago as consulting engineers. W. B. Walraven is district engineer for the Springfield Sanitary District with W. E. Dawson, F. P. Schrader, C. C. Wood, R. V. Tilly, H. W. Bush and L. A. Wilson as resident engineers. Every part of the project was under the direct supervision of graduate engineers with at least four years' experience. The contractors for the project were: Hanson and Willadsen, Omaha, Division A; Sangamon Construction Co., Springfield, Division B, C, G, and Cook street pumping station; Floyd Shofner, Atchison, Kansas, Division E; H. C. Willadsen, Omaha, Division F; Merkle Contracting Company, Kansas City, Walnut Street pumping station; Lock Joint Concrete Pipe Company, precast concrete pipe; Bierd, Lydon and Grandpre, Chicago, the treatment plant units; and the Dorr Company, agitator equipment.

1930 Road Show Scheduled for Atlantic City

The 1930 convention and road show of the American Road Builders' Association will go to Atlantic City. The nation's largest assemblage of men, machinery and materials will gather for the 27th annual event, January 11th to 18th, according to an announcement made May 3rd at the annual business session of the association, by Frederic A. Reimer, consulting engineer of East Orange, N. J., the incoming president.

The president's dinner and installation of new officers followed a two-day meeting of all association committees, divisions and the directorate. Reimer succeeded R. Keith Compton, Richmond, Va., who became a director.

James H. MacDonald, New Haven, Connecticut, continues his years of service as treasurer, and Charles M. Upham, Washington, D. C., continues as secretary-director.

Other new directors are J. S. Helm, Standard Oil Company, New York, and Arthur W. Dean, chairman, state highway commission, Boston, Mass.

Senators, representatives and high government officials joined with diplomatic representatives of many Pan-American countries at the dinner tonight. A majority of the United States were represented by road builders, engineers and others connected with the industry.

Atlantic City was chosen for the 1930 meeting after a long and vigorous fight on the part of Cleveland to have the road builders return there. Cleveland has entertained the past two gatherings, the most successful in the organization's history. St. Louis also was a spirited bidder for the meeting.

COMING CONVENTIONS

American Road Builders Association—January 11th to 18th, 1930. 27th annual convention and road show, at Atlantic City, New Jersey.

American Society for Testing Materials—June 24th to 28th. Thirty-second annual meeting, at Chalfonte-Haddon Hall, Atlantic City, New Jersey.

25 YEARS AGO

AN event occurred in Philadelphia on June 1, 1904, that was to be of great importance to the magazine CONCRETE which was then mailing its fourth issue. That event was the founding of a new magazine—*The Cement Age*—which, twelve years later, was consolidated with CONCRETE.

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THE new *Cement Age* made its modest bow to the engineering public in the form of a paper "The Many New Uses and Increasing Demand for Plastic Materials," written by Robert W. Lesley, the founder and first editor of the new magazine.

In this paper Mr. Lesley presents an imposing table in which he lists the many possible uses of cement. The list is grouped under the following heads: Railroads, Farming, Factories, Dwellings, Municipal, Buildings, Recreation, Marine, Mining and Ornamental. It is interesting to note that one of the branches of the concrete industry which has since grown to proportion where it now uses approximately one-third of the cement manufactured—concrete pavements—is mentioned in this list only under the titles "curb and gutter" and "foundation for streets."

Mr. Lesley says in conclusion: "It is certainly an age of plastic material, of this permanent, enduring, constantly gaining material, a material that can be used in the most decorative way, and a material that can be used in the strongest and most substantial structures. I have outlined only in a brief way these numberless purposes, and no doubt these uses will elicit thoughts and ideas extending beyond any that have hitherto been expressed. Cement is one of those substances to whose uses we have suddenly awakened, and these new uses are coming before us at every turn."

—And these statements are even more true today than they were in June, 1904. It was vision and faith like this that was largely responsible for the growth of our industry.

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THE lead article in the June, 1904, issue of CONCRETE is written by Richard K. Meade on "The Development of the Cement Industry in the United States." Mr. Meade traces the beginnings of the industry in England with the invention of portland cement by Joseph Aspdin in 1824. He tells of the manufacture of "Rosendale" cement—a natural cement first made in the Lehigh Valley. Then he traces the beginnings of the manufacture of true portland cement by David O. Saylor. The ruins of these first portland cement kilns, incidentally, may still be seen near Siegfried, Pa.

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ADDITIONAL reports regarding the performance of various construction materials in the Baltimore fire occupy considerable space and the discussion of wet versus dry concrete is continued. This month, it seems, the dry advocates have the best of the argument, but the discussion is far from settled and the tide of battle will be reported in this column from time to time.

Two other subjects that have a familiar sound to present day readers also appear on the scene, namely, cloth versus paper sacks and cement imports.

Organizations

American Concrete Institute; **Harvey Whipple, Secretary, 2970 West Grand Blvd., Detroit, Michigan.**

American Concrete Pipe Association; **M. W. Loving, Secretary, 33 W. Grand Ave., Chicago.**

American Construction Council; **Dwight L. Hoopingarner, Executive, 28 W. 44th St., New York City.**

American Engineering Standards Committee; **Dr. P. G. Agnew, Secretary, 29 W. Thirty-ninth St., New York City.**

American Road Builders' Association; **Miss E. A. Birchland, Secretary, 29 W. Thirty-ninth St., New York City.**

Twenty-seventh annual convention and road show, January 11th to 18th, 1930. Atlantic City, New Jersey.

American Society of Civil Engineers; **Geo. T. Seabury, Secretary, 33 W. Thirty-ninth St., New York City.**

American Society for Testing Materials; **C. L. Warwick, Secretary-Treasurer, Engineers' Club Building, 1315 Spruce St., Philadelphia, Pa.**

Thirty-second annual meeting, at Chalfonte-Haddon Hall, Atlantic City, New Jersey, June 24th to 28th.

Associated General Contractors of America; **D. H. Sawyer, Secretary, 1150 Munsey Bldg., Washington, D. C.**

Cast Stone Institute; Frank M. Brooks, Secretary, Pasadena, Calif.

Building Officials Conference of America; **Col. John W. Oehmann, Secretary, 1253 Lawrence St., N. E., Washington, D. C.**

Concrete Reinforcing Steel Institute; **M. A. Beeman, Secretary, Tribune Tower, Chicago.**

Iowa Concrete Products Association; **R. L. Gavin, Secretary-Treasurer, 1002 Hubbell Bldg., Des Moines, Iowa.**

National Association of Builders' Exchanges; **Earl F. Stokes, Secretary, 15 E. Fayette St., Baltimore, Md.**

National Concrete Products Association; A. G. Swanson, Secretary, Omaha, Nebr.

National Crushed Stone Association; **J. R. Boyd, Secretary, 751 Earle Building, Washington, D. C.**

National Fire Protection Association; **Franklin H. Wentworth, Secretary, 40 Central St., Boston, Mass.**

The National Lime Association, **Norman G. Hough, Secretary and Manager, 927 Fifteenth St., N.W., Washington, D. C.**

National Sand and Gravel Association; **V. P. Ahearn, Executive Secretary, 432 Munsey Building, Washington, D. C.**

National Slag Association; **H. J. Love, Secretary-Treasurer, 937 Leader Building, Cleveland, Ohio.**

Northwest Concrete Products Association; **F. R. Zaugg, Executive Secretary, 803 Seaboard Building, Seattle, Wash.**

Ohio Concrete Products Association; **G. M. Friel, Secretary-Treasurer, 2284 North High St., Columbus, Ohio.**

Portland Cement Association; **William M. Kinney, General Manager, 33 W. Grand Ave., Chicago.**

Rail Steel Bar Association; **H. P. Bigler, Engineering Secretary, Builders' Building, 228 N. La Salle St., Chicago, Ill.**

Wisconsin Concrete Products Association; **Jack Franklin, Secretary-Treasurer, 3115 Plankinton Arcade, Milwaukee, Wisconsin.**

New Equipment and Materials

New Concrete Form Clamp Saves Wires

The E-Z form clamp, made by The E-Z Clamp Company, Box 193, Winnetka, Illinois, has been placed actively on the market.

The clamp is designed to eliminate the use of exterior bracing in forms for concrete walls and columns. Wires are not twisted within the form, so that they can be removed and used again. The form clamps are tightened and later removed by a convenient tool similar to a carpenter's brace. The manufacturers claim an appreciable reduction in labor costs on form erection and removal.

The clamps are said to be in actual service now on a number of construction projects in Chicago and vicinity.

A New Novo 3½-Ton Hoist

A new hoist, the WH, has just been designed by the Novo Engine Company, Lansing, Michigan, for handling loads up to 3½ tons. The standard line speed is 250 feet per minute, the greater loads, of course, being handled at lower speeds, it is stated. A special high speed one drum hoist is included in the series that has a line speed of 480 and 520 feet per minute and a load capacity of 1500, 2300 and 2700 pounds. The regular hoists are manufactured in one, two and three drum units.

Silver Seal New Wear Resistant Coating

"Silver Seal"—a product recently announced by the Asphalt Products Company of Syracuse, New York—is being marketed on the basis of being a wear-resisting, light and heat-repelling and moisture-proof surface coating. It is said not to peel, check or crack under any climatic conditions.

McCracken Makes Two Improvements on Pipe Machines

Engineers, officials and contractors who specify, approve and use sewer pipe will be interested in the announcement that McCracken corrugated concrete pipe are now made in three foot lengths instead of thirty-inch lengths, as was formerly the case.

McCracken concrete pipe are made in a number of strategically located local plants. These plants operate McCracken concrete pipe machines, manufactured by the McCracken Pipe and Machinery Corporation, Sioux City, Iowa.

The McCracken Company announces a second improvement in concrete pipe manufacture which increases the daily output of each plant and results in a definite improvement in the product. The McCracken machine automatically manufactures sewer pipe from six to twenty-four inches in diameter, three feet long. Each pipe is made in a steel jacket which is released from the green pipe immediately the product has been wheeled to the curing room.

In every McCracken pipe plant a conveyor line keeps the mixer supplied with raw dry materials and the mixed concrete is discharged into the elevated boot of the pipe-making machine. From that point to the completion of the manufacturing cycle, the operation is automatic. The elevator lifts the mixed concrete above the mold which stands on a revolving table, depositing it in a circular batch hopper just above the mold.

Hence the concrete feeds automatically into the mold when the revolving wall packer reaches the bottom of its downward stroke. At this point the auxiliary bell packing head is at its top position, making the bell or socket of the pipe. This requires from five to seven seconds. At the same time the wall packer on the main vertical shaft is packing the shoulder above the socket. Then the two packers draw apart, the bell packing moving out of the finished socket and the wall packer rising through the pipe packing the wall as it rises.

Until quite recently as much time was consumed in sending the wall packer down through the mold, which is an unproductive trip, as was consumed in bringing the wall packer up through the mold during its packing operation. Thus 50 per cent of the time of the wall packer was unproductive. An improvement of the machine has resulted in cutting the unproductive time of the wall packer down to 20 per cent. In other words, the wall packer travels on its downward trip much faster than it travels on its upward trip.

The concrete is securely packed by the wall packer and this method of condensing the concrete in the pipe being formed is so efficient that McCracken concrete pipe are one of the few concrete pipe made which have the minimum wall thickness allowed by the specifications of the American Society for Testing Materials and still exceed the strength requirements of those specifications by a very wide margin, it is said. The McCracken process also packs the bell of the pipe just as densely as it does the rest of the pipe and gives the interior of the bell the same glazed finish as it gives the rest of the pipe.

New Mixer Weighs Water and Aggregate

A new mixer called the Weigh Mix was recently developed by the Koehring Company of Milwaukee, Wisconsin, in response to a desire for a portable concrete manufacturing plant that could be charged with available equipment and which would be capable of accurate proportioning of materials by weight.

It consists of a standard Koehring mixer, equipped with a weighing batch hopper and water tank mounted on an auxiliary frame carrying pipe lever scales.

All operations are controlled from the operating platform by one man. Materials are weighed into one hopper, thereby allowing for the use of as many aggregates as may be desired; gravel is normally weighed in first, followed by cement and sand; the water is weighed on the same beam and is carried in an open tank.

When the batch hopper door opens to allow for the charging of the mixer, the batchmeter is actuated and the hopper shaking device, operated by a cam on the main driving shaft, is started. The batch hopper discharges quickly, cleaning perfectly so that the scale will return to balance.

Due to the shape and position of the hopper, bulk cement and any number of differently graded aggregates can be weighed without additional equipment.

The batch hopper does not come in contact with the weighing mechanism while being shaken and therefore the accuracy of the weighing mechanism is not affected. The scale beam is boxed so that it can be taken off the plant for transportation.

A New Versatile Saw for Form Work

Of interest to those using saws is a new type of unit recently perfected and put on the market by J. D. Wallace & Company, Chicago.

The machine is portable, and can be shifted to suit the location of the work. It derives power from the ordinary lighting circuit or the power circuit, alternating or direct, 25, 30, 40, 50 or 60 cycle.

This new machine known as the Workace radial saw, is easily adjusted to cut at any angle, for cross cutting or ripping, dadoing or grooving, rabbeting, routing, panel raising, shaping, sanding, etc., according to the manufacturer.

About Makers of Equipment and Materials

INDUSTRIAL LITERATURE

Actual Mix on Color Cards

Designed to furnish users of cement colors more exact reproductions of popular color effects than in the past, new cards issued by *Geo. S. Mepham & Co.*, East St. Louis, Ill., bear actual samples of cement, sand and color mixed.

Form 502-*CC* shows actual reproductions of concrete made up with a 1:2 mix and ten pounds of color to the bag of cement. Another, *No.* 503-*CC*, shows color effects for interior wall finish and exterior stucco. Color formulas, together with instructions for mixing, are given on the backs of the cards.

On Tee Stone

Tee Stone, "A new development in the art of concrete 'T' beam elements" is the subject of a 12-page publication dealing with the uses of this new building product.

The units are described as being precast, properly cured, reinforced structural concrete building elements covering a wide variety of architectural application.

The contents consist mainly of illustrations, showing many types of applications. *The Tee Stone Corporation*, New York City, is the licensor.

Sand Tester

"A little book about sand" has just been published by *Kolesch & Co.*, New York City, dealing from all angles with sand as a material. It advocates, primarily, the testing of sand to insure quality, by means of the "Universal" sand tester. The device consists of a graded series of standard mesh screens in a watertight casing; a series of glass vials communicating with the screens, and means for holding and making a graphical record of tests.

Dean Inserts

A small four-page leaflet recently distributed by *Olney J. Dean & Company*, Chicago, describes the Dean malleable inserts. These are designed to form a substantial method for supporting machinery, shafting, overhead trolleys and sprinkler systems on the floors, columns, wall or ceilings of concrete structures.

Nu-Block Literature

A reproduction of a commendatory letter and an isometric sketch showing *Nu Concrete Block* installed comprise literature recently received from the *Bridgeport Stone Company*, Bridgeport, Conn.

Name Wanted

An unnamed *Consolidated Concrete Machinery Corporation* publication made its inaugural appearance during April, in the form of a 9 by 12 inch leaflet which is to be issued regularly.

The publication contains numerous short items of interest and help. The Consolidated Company, Adrian, Mich., also invites products manufacturers to submit their ideas of names suitable for the publication, their plan being to award an Anchor stripper to the person submitting the name selected.

Mixers and Best Sellers

CONCRETE is in receipt of a catalog, No. 29, descriptive of the concrete mixers and saw rigs produced by the *Knickerbocker Company*, Jackson, Michigan.

The Knickerbocker advertising representatives, in submitting the publication say, "This book differs from 'The Cradle of the Deep' (a current best selling book) in these particulars: 'The Cradle of the Deep' was published by Simon and Schuster; the enclosed book by The Knickerbocker Company, aided and abetted by us. Second, the windjammer book, so its publishers admit, contains 'a large element of romanticized fact' while our effort speaks the simple unadorned truth about a good piece of equipment."

On Spray Painting

Information on the spray method of applying paint and other liquids is available in the form of a 32-page publication which is at the same time a catalog.

Cross section views are shown of the various parts of the portable spray-painting equipment included in this publication and their construction explained.

The DeVilbiss Company, Toledo, Ohio, publishes the catalog, which is known as the "PA."

Silicate Curing

The Philadelphia Quartz Company, Philadelphia, Pa., has issued a four-page folder on the subject of silicate concrete curing, explaining its purpose and application in pavement work.

Eight states are listed as having specified silicate curing, while four are said to permit such curing with the engineer's approval.

New "Quikard" Plant

A recent four-page folder received from the *Ash Grove Lime and Portland Cement Company*, Omaha, Nebraska, announces the opening of its new cement manufacturing plant at Louisville, Nebraska. Both the Ash Grove high early strength cement "Quikard" and its ordinary portland are being manufactured at the new plant.

Notes from the Field

Johns-Manville Removal

The Johns-Manville Corporation announces the removal on May 1st of its Western Division headquarters from South Michigan Avenue and 18th Street to 230 North Michigan Avenue, Chicago.

The new offices, occupying larger space required by the rapid expansion of the business, are located in the Carbide and Carbon building.

Daggett Joins Machinery Company

Gordon F. Daggett, formerly executive secretary of the Wisconsin Mineral Aggregate Association, has become a member of the firm of *Boehck Machinery Company*, Incorporated, Milwaukee, Wis., and holds the position of chief engineer.

International Warehouse at Washington

The International Cement Corporation, New York City, has announced plans for a large reinforced concrete cement warehouse, with complete cement packing plant which is now in the course of construction at Washington, D. C.

A temporary warehouse at this location is now in service and will be used until the new plant is completed.

Novo Distributors

The following have recently become Novo distributors handling Novo equipment: *Jersey Contractors Equipment Co.*, Plainfield, N. J.; *Fitzgerald & Hudson*, New York City, N. Y.; *Fred Lemcke*, Jackson, Mich.; *Wylie Bros., Inc.*, Tulsa, Okla.; *R. L. McDonald, Inc.*, Springfield, Mo.; *Anderson Tractor & Equipment Co.*, Biltmore, N. C.; *Tennessee Tractor Co.*, Nashville, Tenn.; *Mine & Smelter Equipment Co.*, Phoenix, Ariz.; *Lund & Co.*, Salt Lake City, Utah.

R. T. McClelland, Inc., Oakland, California, who have been Novo distributors for several years, are now located in San Francisco and are known as *Krantz-McCelland, Inc.*, San Francisco, Calif.